PEST CONTROL

MARCH 1961

CDC's Pesticide Suggestions for 1961
Pg. 9

Correspondence Course Lesson 3 "Pesticides"
Pg. 29

Reports of the First 3 Regional Pest Control Operators Conferences Held This Year:

Southern **Pg. 38**

Purdue **Pg. 42**

Eastern **Pg. 56**

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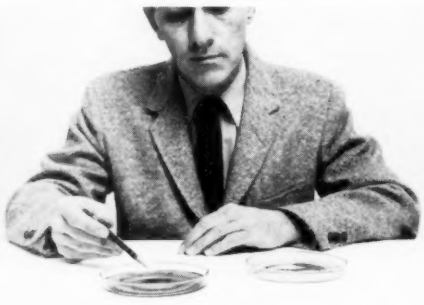

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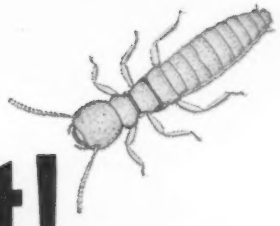
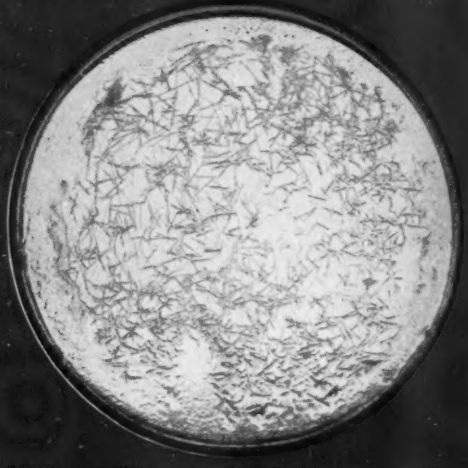


LOOK AT THE DIFFERENCE!

Chlordane, after the two week test period, remains a heavy, viscous liquid. It provides an unbroken barrier that no termite could penetrate.



The crystalline insecticide, after two weeks, has formed isolated islands of protection, separated by wide open spaces that termites could easily penetrate.

Now you can actually see one of the reasons why Chlordane provides longer residual termite control. This do-it-yourself termite barrier test shows that Chlordane always remains a sticky, viscous liquid. In the soil, it combines with every soil particle, to form an unbroken barrier. Crystalline insecticides react in a different way. They form hard, solid crystals, as soon as solvents evaporate. These crystals form isolated islands of insecticide, separated by big gaps that afford no protection.

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PEST CONTROL

March, 1961

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No Place for Ostriches

There's no way to beat the game. Either you follow the rules or you takes the consequences.

Never was the truth of these clichés more clearly reflected than in the 80% increase in premiums PCOs now pay for property liability insurance.

For as long as we can remember, this industry has been cautioned to carefully test-apply an insecticide before it is to be brought into contact with an unfamiliar surface. Yet this advice has not been taken very seriously.

What's happened? Heretofore lax application methods enabled most servicemen to apply their relatively non-staining insect killers on simple, nature-based surfaces with no resulting damage. Then science compounded progress with a rapid introduction of new man-made materials and more complex groups of pesticides. Minimal precautions are no longer adequate to prevent damage to marble, plastics, synthetic fibers, etc. The resultant increase in number of claims has been reflected in higher premiums which are, as everybody knows, based upon experience.

It was inevitable that such troubles would develop if training and supervision was not all it should have been.

Isn't it obvious that the way to reduce insurance costs again is to enforce precautionary application procedures and to see to it no pesticide is applied on any job until a staining test is made in a place where it won't be noticed?

And why isn't there more research on how these new surfaces react to pesticidal chemicals? When attempts have been made to gather field experience on which chemicals and solvents cause the most troubles on what kinds of surfaces, questioners have been advised not to call attention to these difficulties. This is no place for ostriches with their heads in the sand. The problem isn't going away until somebody does something about it.

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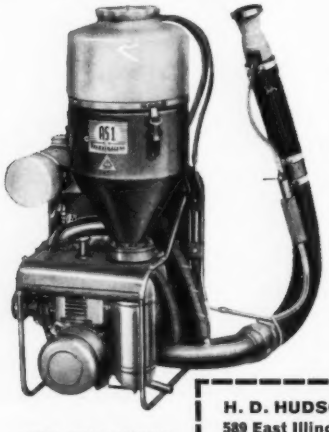

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Letters

One Host Too Few

Dr. C. N. Smith, head of our USDA Orlando laboratory called to my attention the listing of *Haemaphysalis leporis-palustris* (Pack.) in my article "Tick Biology, Habits, and Control" (December, '60, pg. 9) as an example of a two-host tick. Careful perusing of several references revealed that I made an error. The rabbit tick is a typical three-host species. Since the species was used only as an example, we hope the error does not detract significantly from the information in the paper.

Dr. Roger O. Drummond

Agricultural Research Service
U.S. Department of Agriculture
Kerrville, Texas

Suggests Unpopped Corn for Bait

I would like to pass on an experience that I have had with rats. My company does work for the Bar K Guest Ranch, one of the largest in central Texas. Rats infesting the ranch would eat bait only if it was put in ground steak. Conventional baits were passé to their appetites. This was very expensive because they had Texas appetites. The ranch's chief chef, Gene Yelvington, suggested putting warfarin in a regular corn base and then sprinkle it with un-popped popcorn. Well those rats went after it so fast that all are now wiped out.

Dorothy Kerbow

Dot Pest Control Service
Austin, Texas

CP11223 Available?

Please tell me where I can buy Monsanto CP11223 described in "Results of 1960 Cockroach Tests at VPI," (Jan. '61, pg. 30)

Foster Thompson

Allied Termite and Pest Control
Texarkana, Texas

Monsanto Chemical Co.'s CP-11223 is still being tested and is not yet ready for the market. Ed.

Pest Control welcomes expressions of opinions from its readers. Send ideas and comments as briefly as possible to James A. Nelson, Editor, Pest Control, 1900 Euclid Avenue, Cleveland 15, Ohio.

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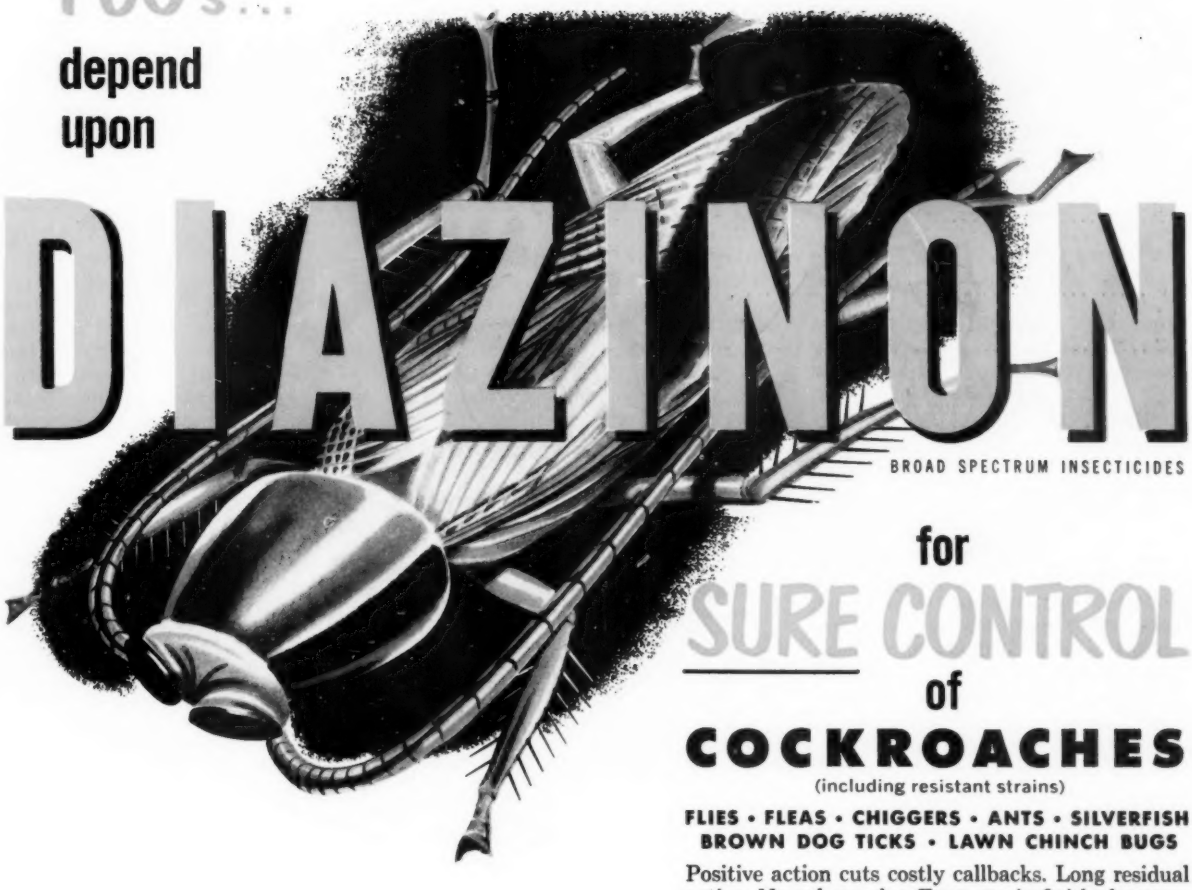
PCO's...
depend
upon



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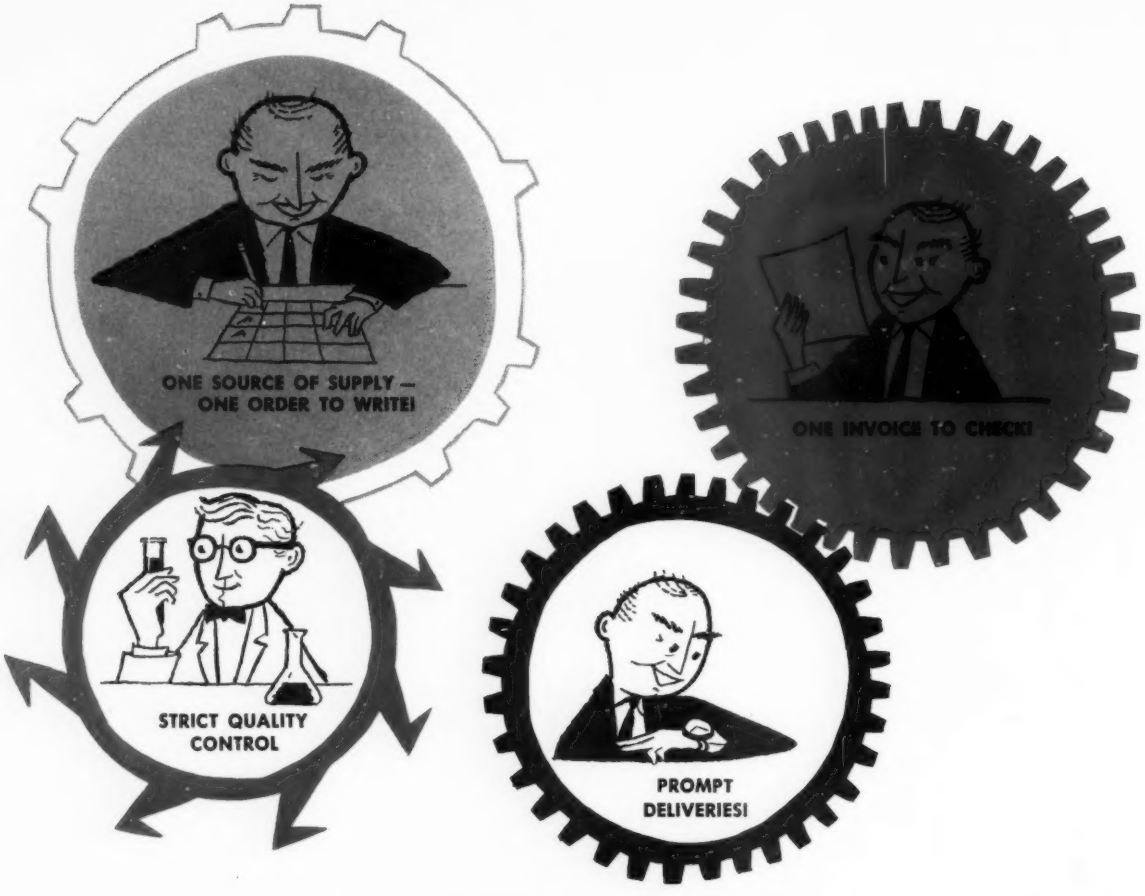

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1961 **Report from the Communicable Disease Center**

Public Health Pesticides

for mosquitoes, flies, fleas, roaches, bed bugs, ticks, chiggers, lice, rodents

from the Technical Development Laboratories, Technology Branch,
Communicable Disease Center, Public Health Service,
U. S. Department of Health Education, and Welfare, Savannah, Georgia

PUBLIC HEALTH Pesticides, an annual release of the Communicable Disease Center, presents information on the current status of pesticide use for the control of arthropods and rodents of public health significance. The data compiled are derived from investigations of the Communicable Disease Center, supplemented by published findings and the unpublished results furnished by certain research organizations.[1] This release is not a summation of the control measures that can be employed against arthropods and rodents; specifically, it is designed to keep operational personnel currently informed on toxicants which are effective and safe to use in the control of these pests. The number of pesticides in general use obviously precludes consideration of all toxicants capable of suppressive action on the pests discussed. Data on compounds still in the experimental-use stage and as yet unavailable for public usage usually are omitted. Information on such compounds can be obtained from the Technical Development Laboratories, Communicable Disease Center, P.O. Box 769, Savannah, Georgia. Inquiries should be specific as to the compound involved and the insect in question.

One of the major difficulties in any resume of technical information on insect control is the fact that the results of insect investigations may be closely allied to the geographic area in which the work is conducted. Few chemical measures are equally effective against a number of species under a variety of environmental conditions. In this regard, the biological efficacy of a given toxicant against a particular species of insect may vary considerably in different localities according to prevailing ecological and biological factors. Failure to recognize differences in insect response is a basic reason behind control difficulties.

A second cause of control failure is the attempt to place full reliance upon a chemical treatment instead of recognizing that pesticides usually are secondary to or supplementary to measures which reduce or curtail the breeding potential of the pest. Permanent control measures, such as reduction of mosquito breeding sites (by drainage, filling, etc.) or the proper storage and disposal of garbage in a fly control program, are a pre-requisite to effective abatement. Conversely, it is true that while the application of insecticides is subordinate to adequate sanitational measures, maximum reduction of arthropod and rodent densities usually cannot be achieved without the use of chemicals. While this comment is true for arthropod control, it may not apply to disease control since the latter has been accomplished in some countries with pesticides which affect only a segment of the arthropod population (i.e., mosquito vectors entering habitations).

A third factor behind unsuccessful arthropod and rodent control is the tendency of operational personnel to rely on a single type of treatment or toxicant, thus making the chemical measure and the operational program one and the same. In most instances this approach is inefficient since the individual measures are merely specific tools which, on an operational program, are to be used at the discretion of the supervisor. From his familiarity with these tools and with the habits of the insect, the supervisor is in a position to select one or more measures which can best be used in a given situation. Thus, a poultry man, instead of relying on either poison baits or impregnated cords for fly control may find that the combined use of the two techniques will provide the highest level of abatement. The cords would serve as a long-term suppressive measure, the baits being used for emergency applications in the event that sanitational deficiencies caused a temporary upsurge in fly production beyond the control capacity of the cords. The ability to organize a system of effective insecticidal applications stems largely from the background, experience, and training of the supervisor, qualifications that cannot be over emphasized.

Insect resistance to pesticides has been a major problem in many areas. While recognition of the magnitude of this problem was slow, the trend during the past several years has been to ascribe any absence of control effectiveness to resistance. Fortunately, technical procedures are available which enable the control operator to determine if resistance is present in a species. By use of these techniques the cause behind unsuccessful abatement may be determined. Too often sloppy spray techniques, inadequate knowledge of insect habits, and a low standard of sanitation are hidden beneath the guise of resistance.

Another fallacy in the interpretation of resistance data is the tendency to place undue emphasis on a slight change in the response

1. Particular acknowledgement is made to the Entomology Research Division, U.S. Department of Agriculture[A]; and to the California Department of Public Health, Bureau of Vector Control[B]; for providing certain unpublished experimental data for inclusion in this resume. References to these organizations in the text are shown by small capital letters as indicated above.

of the insect to a given toxicant. *Any decrease in susceptibility must be coupled with observation of the field efficacy of the chemical treatment before the operator seeks another or considers a change of toxicants or of procedure.*

In considering a chemical measure, the operator desires a toxicant which is highly effective against the pest yet remains in the range of human safety when used as prescribed, and at the same time is economical, easy to apply, and non-injurious to treated surfaces. In this resume, specific recommendations are not made as to the best compound for each particular purpose. Obviously, each control situation demands greater emphasis on certain characteristics of the pesticide (i.e., odor, cost, toxicological hazard, persistence). Thus, each operator is required to make his own evaluation as to the "best" toxicant to employ.

In formulating and applying any pesticide, the user must follow handling practices which minimize the hazards of contaminating food, water, animals, or man. Because certain of these chemicals are extremely toxic to man and animals, greater care must be exercised in their formulation and application. Usually toxicological data on new insecticides are, of necessity, based on experimental studies with small mammals (rats, mice, rabbits). Such data are extremely valuable from the standpoint of comparing the relative toxicities of the different compounds. However, in relating these data to human safety, consideration must be given to the chemical properties of the toxicant (absorption characteristics, stability, etc.) formulation, use concentration, and exposure time, e.g., a low concentration of a compound of high toxicity employed as a water suspension may entail less human hazard than an oil solution of lower toxicity when the latter is applied at a much higher concentration. In some instances, the relative order of toxicity of different compounds may vary in accordance with the species of animal involved.

Throughout the major part of this release, the dosage of toxicant employed is expressed as technical material in terms of milligrams per square foot, pounds per acre, or parts per million. The dosage of the toxicant applied is dependent upon the concentration of the formulation used, together with the rate at which the material is dispersed. Thus, a 1% formulation sprayed on a surface at the rate of 1 gallon per 500 square feet provides a dosage in milligrams per square foot equivalent to the treatment of 1000 square feet with 1 gallon of a 2% formulation. Data for assisting the reader in preparing formulations are given in tables 1-4.

The choice in selecting the concentration and type of formulation is influenced by the coverage necessary, type of surface to be treated, toxicity of the pesticide, transportation requirements, and the equipment available. Methods for preparation of dusts, solutions, etc. of varying concentrations are outlined in the "Operational Memoranda on Economic Poisons" issued by the Communicable Disease Center.

MOSQUITO CONTROL

Resistance of various mosquitoes to insecticides continues to be a pressing problem in this field of insect control. At present there are more than 37 species in which physiologic resistance to the chlorinated hydrocarbon pesticides has been demonstrated. In areas where culicine species are no longer controlled by the chlorinated hydrocarbon compounds, the organophosphorus toxicants have proved to be effective replacements. Resistance to the latter materials is limited, being most prevalent in California where populations of *Aedes nigromaculis* resistant to malathion or parathion have been found. Malathion resistance also has been shown in *Culex tarsalis*. In California, both parathion and malathion larvicides have been employed for more than 7 years and there are many localities where each remains effective against these two species.

Residual Adulticides

In many countries, including the United States, the insecticide most commonly employed for residual treatment of homes is DDT. The dosage is either 100 or 200 mg. of toxicant per square foot (approximately 1 gallon of 2.5 or 5% spray, respectively, per 1000 square feet). Resistance to DDT among the anophelines in the United States is recorded only for *Anopheles quadrimaculatus* in specific localities of Georgia and Maryland; elsewhere in the world, DDT resistance is of greater significance. Nonetheless, at present this toxicant is used far more extensively than all other compounds. Where resistance to DDT is of practical significance, dieldrin or BHC (50 mg. per sq. ft.) may be used. The dosage and cycle of treatment followed with these chemicals is dependent upon the susceptibility of the vector, house construction, and environmental conditions. Comparative studies of the length of residual action of DDT and dieldrin on plywood surfaces in animal-baited huts against *A. quadrimaculatus* show that at

Table 1. Number of gallons of finished spray of varying concentrations required to produce specific dosages of toxicant in milligrams per square foot.

Percent concentration of formulation	Gallons of spray required per 1000 sq. ft. to give:			
	200 mg./sq. ft.	100 mg./sq. ft.	50 mg./sq. ft.	20 mg./sq. ft.
5.0	1.0	0.5	0.25	0.1
2.5	2.0	1.0	0.50	0.2
1.0	5.0	2.5	1.25	0.5
0.5	10.0	5.0	2.50	1.0
0.25	20.0	10.0	5.00	2.0

Table 2. Number of pounds of dusts of varying strengths required to produce specific dosages of toxicant per acre.

Percent concentration of dust	Pounds of dust required per acre to give toxicant dosage of:				
	2 lb./A	1 lb./A	0.5 lb./A	0.2 lb./A	0.1 lb./A
5.0	40	20	10	4	2
3.0	66	33	16	7	4
2.0	—	50	25	10	5
1.0	—	—	50	20	10
0.5	—	—	—	40	20

Table 3. Preparation of emulsions: Volume of water per single volume of concentrate.

Percent concentrate	Percent emulsion desired					
	0.25	0.5	1.0	2.5	5.0	10.0
	Volume of water					
50	199	99	49	19	9	4
25	99	49	24	9	4	1.5
10	39	19	9	3	1	—

Table 4. Preparation of suspensions: Pounds of powder per 100 gallons water.

Percent water-wettable powder	Percent suspension desired				
	0.25	0.5	1.0	2.5	5.0
	Pounds of insecticide				
75	2.6	5.3	10.7	26.7	53.3
50	4	8	16	40	80
25	8	16	32	80	160

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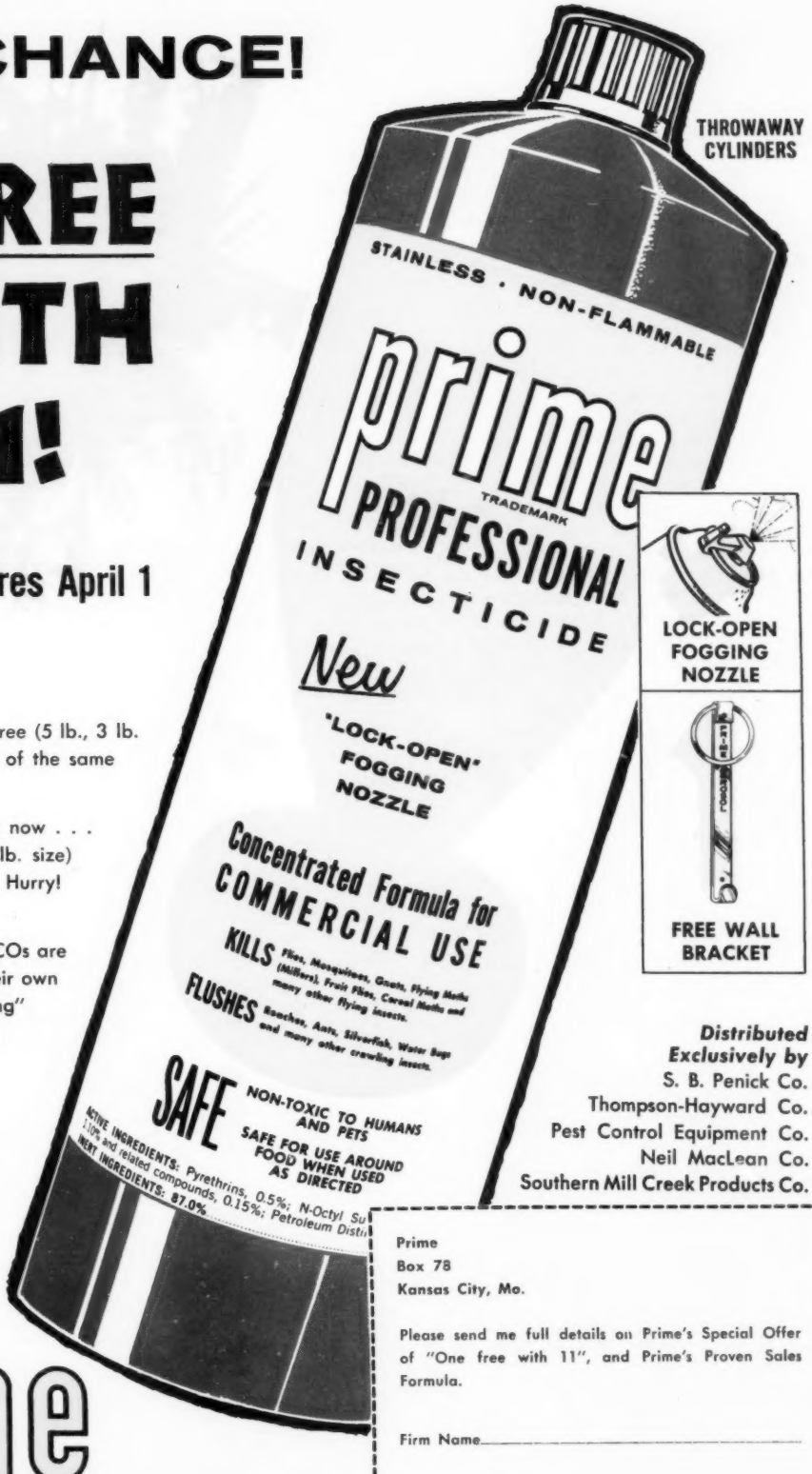
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200 mg. of DDT per square foot mortalities were only slightly higher than those obtained at 100 mg. of DDT per square foot through 36 weeks after treatment. Similar mortalities were obtained with 25 or 50 mg. of dieldrin per square foot through 24 weeks, but thereafter the lower dosage produced progressively inferior results. The higher dosage of dieldrin gave mortalities similar to those obtained with DDT at 200 mg. per square foot. A suspension is the formulation of choice both from the transportation and handling aspects as well as from the standpoint of biological activity. The latter applies particularly to DDT residues, which are most effective against mosquitoes when derived from suspensions.

The occurrence of anopheline populations resistant to both DDT and dieldrin has led to investigations on the potential of the organophosphorus compounds as toxicants for residual spraying of homes. To date two toxicants, malathion and Bayer Compound 29493 (Baytex), have been shown to be effective in field tests for periods of 2½ to 3 months. A comparison of the efficacy of these two compounds on wood, thatch and mud surfaces against *Anopheles albimanus* in El Salvador is given in Table 5. Dosages below 100 mg./sq. ft. of either compound were ineffective.

The residual fumigant technique employing DDVP is a new method of much promise for the control of anopheline mosquitoes inside dwellings. In Georgia, continuing experimentation with this technique has resulted in the development of a solid type cylindrical formulation of DDVP (1.5″ x 5″) which produced 100% kill of caged *A. quadrimaculatus* in closed or naturally ventilated plywood huts (1000 cu. ft. each) for as long as 16 weeks. The effectiveness of the treatment varied with the degree of ventilation; in maximum ventilated huts additional dispensers were required to give the same period of effective kill achieved in the minimum ventilated hut with a single dispenser.

Table 5. Effectiveness of malathion and Bayer 29493 suspensions on different surfaces.

Dosage		100 mg./sq. ft.		200 mg./sq. ft.	
Weeks		12	16	9	14
Surface	Toxicant	Percent mortality			
Wood	Malathion	100	84	85	83
	Bayer 29493	75	51	75	100
Thatch	Malathion	68	8	100	67
	Bayer 29493	30	25	65	45
Mud	Malathion	74	21	70	57
	Bayer 29493	84	48	100	84

Outdoor residual applications are of value as barrier strip treatments around individual premises to give relief from daytime annoyance by certain culicine species. In the Savannah, Georgia, area, DDT applied as a 1.25% emulsion at rates of 5 to 10 pounds of toxicant per acre to the outside of houses and to shrubbery, grass, and other vegetation within a radius of approximately 100 feet of the dwelling caused significant reduction in daytime annoyance from salt marsh mosquitoes for periods of 1 to 9 weeks. The variation in the duration of effectiveness of the DDT treatments was attributed to mosquito potential, more frequent treatments being required when excessive mosquito production occurred. Other pesticides — BHC (1.3 pounds gamma isomer per acre), lindane (0.5 pound per acre), and Diazinon or malathion (2 pounds per acre) — were ineffective. In Montana, similar application of 5% DDT emulsion on farm premises resulted in a 75 to 98% reduction of daytime biting rates of *Aedes vexans* and *A. nigromaculis* for at least 20 days. Because new populations of mosquitoes usually invade an area at dusk, these barrier strip treatments have little effect on nighttime biting rates.

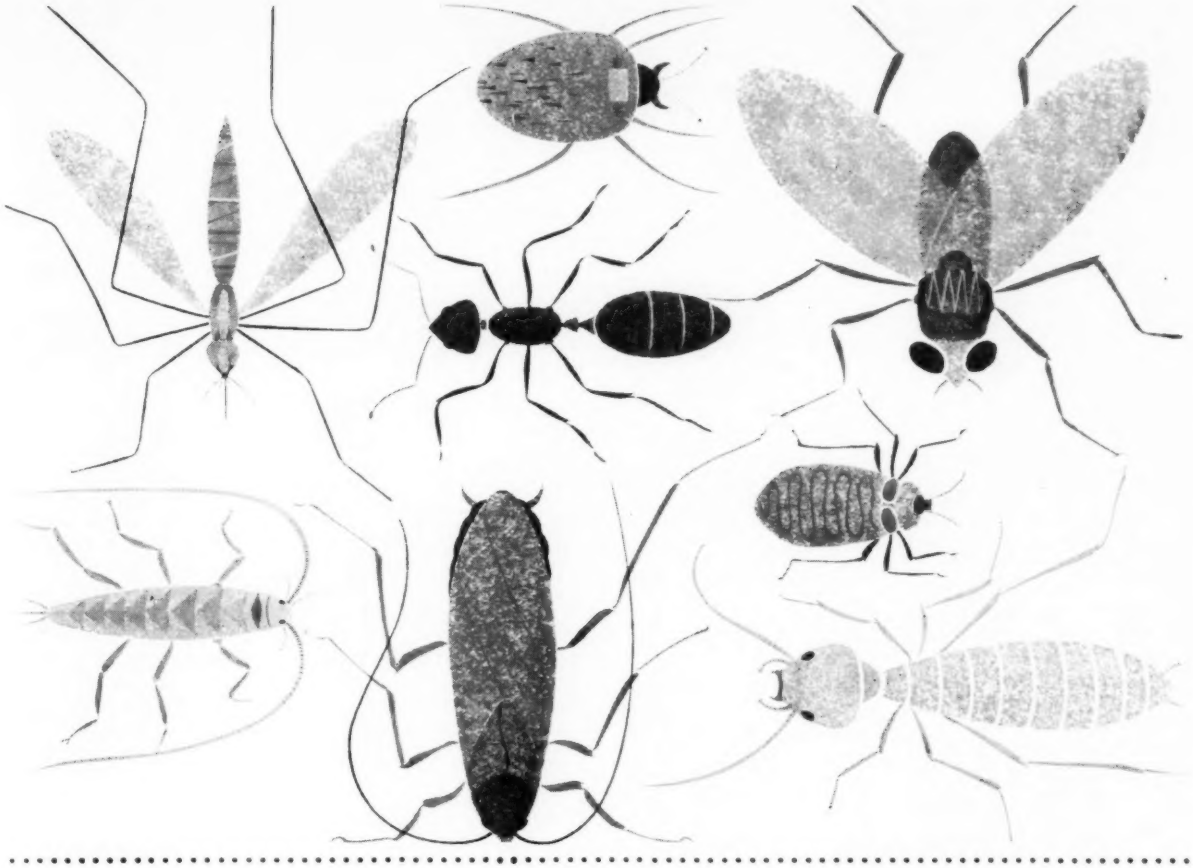
Experimental huts used for studying residual fumigants in Savannah, Ga.

Space Treatments

As a temporary measure to reduce adult mosquito populations to non-annoyance levels, outdoor space treatments are effective when properly timed and applied. To obtain maximum operational efficiency, the supervisor must evaluate the performance characteristics of his equipment with the formulations employed and from these data establish operating procedures under different weather conditions and various types of terrain. As dosage rates of space treatments are calculated on a "pound per acre" basis, the swath width produced by the machine must be predetermined (usually considered as 200 to 300 feet). Over an open terrain the effective swath width is far greater than with a terrain having trees, buildings and other obstacles.

An application rate of 36 gallons of a 5% fuel oil solution of DDT or a 2.5% solution of chlordane or lindane per mile will provide the dosages (0.4 pound DDT or 0.2 pound chlordane or lindane per acre) generally required for satisfactory reduction of mosquito densities. The frequency of space treatments will be governed by the rapidity with which an area is reinfested.

Because of resistance to DDT and other chlorinated hydrocarbon insecticides, increasing use is being made of organophosphorus toxicants in this field. At present malathion is the principal organophosphorus compound in use. Ground dispersed fogs (6% malathion in



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fuel oil, 8 gallons per mile) gave kills of 92 and 87% of caged salt marsh mosquitoes at distances of 330 and 660 feet, respectively. Later tests of mist sprays of malathion emulsion (6%, 25 gallons per mile) produced average mortalities of caged DDT-resistant *Aedes taeniorhynchus* of 89% at distances of 165′ and 330′. Three runs of 5% malathion dust (40 pounds per mile) gave 99% kill at the same distances. DDT (6%) mist and BHC dust (3% gamma, discharged at 80 pounds per mile) were ineffective. However, in Montana 3% gamma BHC dust at 30 to 35 pounds per mile has been shown to reduce effectively nighttime densities of susceptible *Aedes vexans, A. dorsalis* and *A. nigromaculis* in an urban area on the evening of treatment. In Illinois, limited tests with vermiculite granules impregnated with an aromatic solvent[2] (25%) and applied at a rate of 10 pounds per acre to woodland areas indicated that densities of *Aedes trivittatus* and *A. vexans* were reduced to minimum levels for periods up to 4 days. This effectiveness was equivalent to that produced by similar applications of vermiculite granules containing 10% DDT.

At Savannah, Georgia, comparative tests of ground treatments of malathion fog, dust, or spray[3] showed that the fog treatments of 0.1 pound per acre[4] (7.0 gallons per mile) produced adult female mortalities[5] of 98, 53, 39, and 0% at distances of 135′/270′/540′/ and 810′ while the mortalities for dust (0.3 pound per acre, 87 pounds per mile) and spray (0.2 pound per acre, 14 gallons per mile) treatments at the same four distances were 63/81/3/2 and 95/55/32/27%, respectively. In parallel tests of malathion fogs and dusts at approximately 0.1 pound of toxicant per acre, comparable mortalities were obtained at 135′ and 810′ but the fog treatments gave superior kills at the "open" stations at 270′ and 540′. From these and other field tests it appears that the overall effectiveness of fogs is slightly above that of sprays and dusts. This fact, together with the operational advantages of the method

Two disk metal feeder enables measured amount of food (ground dog chow) to be fed mosquito larvae at regular intervals.

and its ready public acceptance, favors it as the technique of choice for routine adulticiding.

In 9 tests at dosages of 0.07 to 0.09 pound per acre, ground treatments of malathion fog gave average kills of 93, 90, 57, and 17% in "open" sites at 135′/270′/540′and 810′. At the "wooded" site average mortalities of 57, 22, 6, and 11% were obtained at the same distances. These data emphasize the variability in effectiveness that can be easily induced by barriers in the path of the fog. Similar erratic results also are encountered with dust and spray applications.

Ground application tests of malathion versus Diazinon, ronnel and DDVP indicate malathion to be equivalent to or superior to these toxicants. Diazinon dust treatments at a dosage of 0.1 pound per acre gave average percent mortalities of 51 and 42 at 135′ and 270′ while the kills with malathion dust at the same distances were 78 and 53% respectively.

In aerial treatments in Florida, Dibrom- and malathion-fuel oil solutions and Sevin-fuel oil suspensions (3 quarts of formulation per acre) were evaluated against salt marsh mosquitoes. Sevin was ineffective at rates of 0.25 and 0.5 pound per acre but malathion and Dibrom gave excellent kills at 0.05 and 0.1 pound per acre. However, results were poor at an application rate of 0.025 pound per acre. Application of thermal aerosols, produced from fuel oil formulations containing 5, 10, or 15% malathion, an equivalent percentage of heavy aromatic naphtha, and 15% fog oil, produced 79-100% kills of caged *Aedes taeniorhynchus* 600 feet downwind.

Lethane 384 or Thanite when added to 2.5% malathion formulation at a 5% concentration in aerial sprays decreased rather than added to the effectiveness of malathion when tested against caged adult *A. taeniorhynchus*. These results with the Lethane 384 additive contrast with those reported in ground tests where a malathion: Lethane (3:3%) formulation gave results comparable to that obtained with malathion alone (6%).

Temporary Larvicides

Susceptible populations of culicine or anopheline larvae can be controlled by DDT (0.05 to 0.2 pound per acre) or dieldrin, chlordane, heptachlor, or lindane (0.1 pound or 5 quarts of 1% formulation per acre).

Where mosquito populations no longer respond to treatment with chlorinated hydrocarbon larvicides, organophosphorus compounds have been the principal chemicals employed. Malathion at dosages of 0.2 to 0.5 pound per acre, parathion at 0.05 to 0.1 pound per acre and Bayer 29493 at 0.025 to 0.05 pound per acre are effective against populations of *C. tarsalis, A. nigromaculis, A. sollicitans,* and *A. taeniorhynchus* resistant to the chlorinated hydrocarbon compounds. In California, tests indicated that malathion and parathion in granular or emulsion formulations were equally effective against *C. tarsalis* and *A. nigromaculis* larvae. Either ground or aerial equipment is used to apply these toxicants. Airplane applications of parathion should be avoided in urban areas because of the high mammalian toxicity hazard of this compound.

Paris green pellets have been shown to be highly effective against salt marsh mosquitoes in the southeastern United States, when applied at the rate of 15 pounds of 5% granules per acre on the ground or from the air. To obtain a finished formulation containing 5% Paris green, calcium carbonate is blended with Paris green (90%) so that the resultant mix contains 20.5% of the toxicant by weight. Twenty-five pounds of the blend is then mixed with 35 pounds of vermiculite No. 3 which has been previously sprayed with 40 pounds of an oil:emulsifier (90:10%)[6] solution. Commercially prepared pellets also are available at 5 and 10% strength. Field tests in Florida with 5% and 2.5% Paris green pellets applied by airplane at the rate of 0.8 and 0.4 pound of Paris green per acre, respectively, gave more than 98% reduction of salt marsh mosquito larvae. Similar reductions were obtained with 7.5

2. Sovacide 544C Special.
3. Fog and spray formulations were 6.5 percent in fuel oil; the dust was 12.5 percent.
4. All dosages per acre calculated on a 300′ swath width.
5. Average of caged specimens in "open" and in "wooded" areas.
6. Suitable oils—Standard Oil Company Nos. 341, 345; Gulf Oil Company Nos. 361, 562; Suitable emulsifier—Triton N-101 (Rohm and Haas Company).

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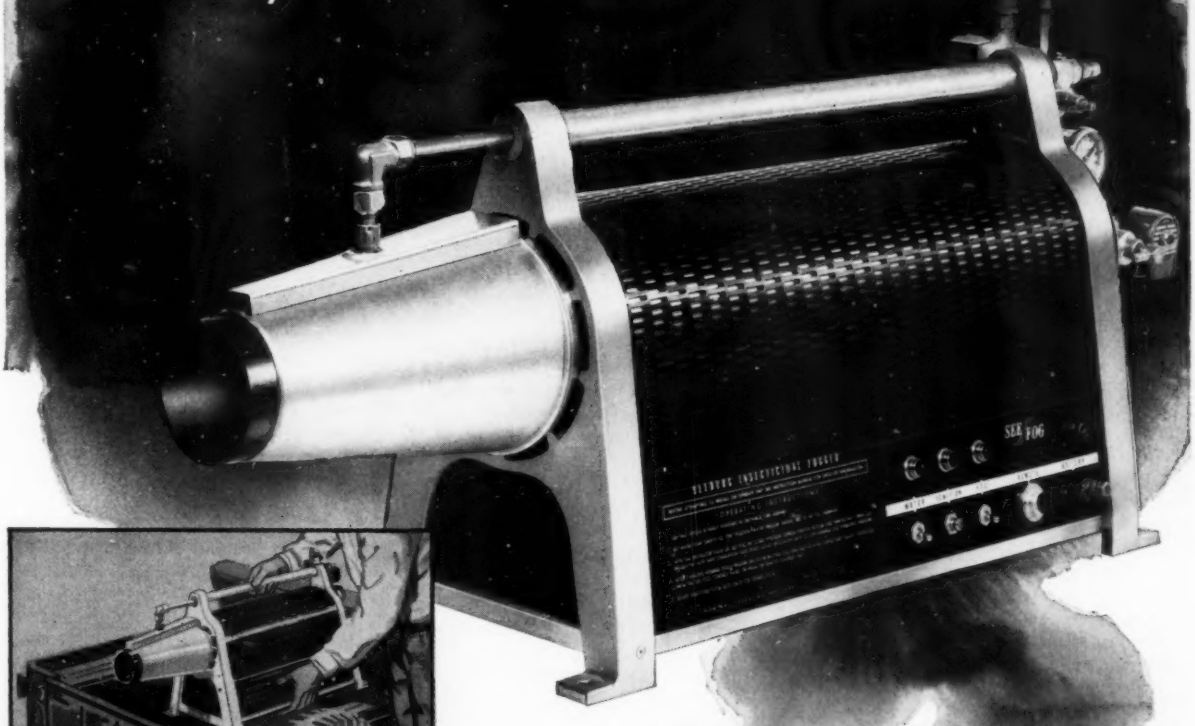

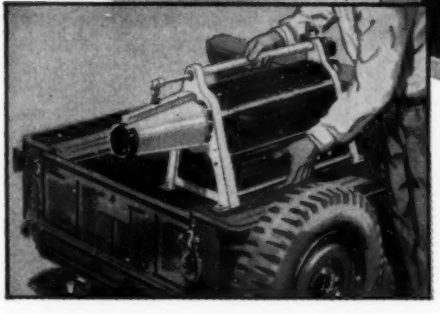

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Table 6. Toxicants Commonly Employed as Residual Larvicides.

Toxicant	Lb./Acre	Type* Treatment	Species** Controlled	Weeks of Effectiveness	Area
DDT***	1.5	G	General	Season	Montana
	3	E	General	12-24	Georgia
	10	E&G	A-D	8&7	Oregon
Dieldrin***	0.25	G	General	Season	Montana
	1	E	General	52	Georgia
	1	E&G	A, E, F	Season	Montana
	1	E	G	Season	Mississippi
	3	E	A-D	14	Oregon
BHC	1(gamma)	E	General	5-8	Georgia
Heptachlor	0.75	G	General	12	Montana
	3	E	A-D	8	Oregon
	5	E&G	A-D	10&13	Oregon
Malathion	3	E	A-D	5	Oregon

*E = Emulsion; G = Granules.

** Species (A = *Culex tarsalis*; B = *C. pipiens*; C = *C. peus*; D = *Culiseta incidens*; E = *Aedes vexans*; F = *A. dorsalis*; G = *Psorophora confinnis*)

*** *When conservation of fish and wildlife are important, dieldrin (1 pound per acre) or DDT (3 pounds per acre) treatments should not be used since they are totally destructive to these animals.*

and 10% formulations. A 1.25% formulation applied at the rate of 0.2 pound of toxicant per acre failed to provide satisfactory reductions of the mosquito larvae.

In controlling floodwater mosquitoes in irrigated pastures and rice fields, parathion (0.01-0.1 p.p.m.); phosdrin (1.0 p.p.m.)[7] and Bayer L 13/59 (0.5 p.p.m.) have been found effective. However, the efficacy of this method of controlling mosquito breeding in pastures is influenced to a great extent by the terrain and by other factors such as seepage. The latter is a critical factor in rice field mosquito control. Although excellent kills of *Psorophora* larvae usually are obtained in the terraces near the injection point, infestations in outlying terraces often remain unaffected because movement of the treated water through the soil either deactivates or removes the toxicant.

Residual Larvicides

Residual larvicides provide control for extended periods, thus differing from the methods previously discussed. With residual treatments the toxicant must be applied at rates far greater than those used for temporary larviciding. The toxicological hazard to fish and other wildlife is thereby increased, thus making it impracticable to employ residual larvicides in situations where wildlife is an important component of the environment. Residual larvicides have been used against species of *Culex*, *Aedes*, and *Culiseta* in different parts of the United States for a number of years. Table 6 summarizes the various toxicants used as residual larvicides and pertinent data relating to such usage.

Residual treatments have been used successfully in land-locked ponds in Georgia, in log ponds in Oregon, in ditches, alfalfa fields and pastures in Montana and in rice fields in Mississippi. In situations where either a pre-flood or post-flood application can be made, pre-flood treatments usually are the most effective. In Montana where a dosage of 0.25 pound of dieldrin per acre gave season-long control as a pre-flood application, the same dosage applied after flooding was effective for 12 weeks. Where forage crops are involved, residual larvicide applications must be limited to "off-field" breeding areas.

Another form of residual larviciding is the use of dieldrin-cement pellets for control of domestic species (i.e., *Aedes aegypti* and *C. quinquefasciatus*). Incorporation of dieldrin water-wettable powder (50%) in sand: cement (5:1) and application at a rate of one 10-gram pellet (content 16.6% dieldrin) to two gallons of water have prevented mosquito infestation for as long as one year in certain parts of the world. Recent tests against mosquitoes in fire barrels in Louisiana indicate that dieldrin-cement pellets killed all *A. aegypti* in fire barrels and the latter remained free of reinfestation for 5 months. In these tests the treatment was ineffective against *C. quinquefasciatus*.

In all larvicide applications, the degree of control obtained frequently is dependent upon the type and amount of vegetative cover present. Consequently, where such cover is heavy, it may be necessary to increase the dosage or the amount dispersed in order to obtain satisfactory results. Under this condition, granular formulations usually provide better control than do emulsions or oil sprays.

FLY CONTROL

Fly control as discussed herein relates principally to measures against the house fly, *Musca domestica*, although other species (blow flies, little house fly, vinegar flies) frequently create problems of local significance. Because of the general resistance of *M. domestica* to the chlorinated hydrocarbon compounds, chief reliance for chemical control is now placed upon the organophosphorus toxicants. Resistance to certain compounds, such as malathion and Diazinon, has appeared in some field populations, particularly after repeated treatments with these toxicants. In addition to physiologic resistance (ability of the insect to withstand exposure to a toxicant to which it was formerly susceptible), house fly populations in certain areas have developed behavioristic resistance (change in behavior, e.g., flies shun baits to which they formerly were attracted). To date, resistance to the organophosphorus compounds is far less widespread in house fly populations than is true for resistance to the chlorinated hydrocarbon pesticides. A summary of the organophosphorus toxicants commonly used in field treatments is given in Table 7.

The use of organophosphorus pesticides in house fly control alters in no way the basic tenet of controlling this pest, i.e., *improvement of environmental sanitation*. Continued efforts to develop new chemicals for insect control has only served to confirm repeatedly the fact that without adequate sanitation, the application of insecticides is a costly and inefficient tool. Every chemical measure, to fulfill its objective, must be accompanied or preceded by adequate sanitational efforts.

Residual Treatments

Three organophosphorus toxicants — Diazinon, malathion, and ronnel — are currently labeled for use against house flies in dairy barns. The addition of sugar to formulations of these toxicants generally augments the efficacy of the residues, but the degree of increase in effectiveness varies with the insecticide involved. Sugar is usually included in the formulation at a rate of 2.5 parts to 1 part of the toxicant.

At Savannah, Georgia, treatment of dairy barns with malathion-sugar sprays at a rate of

7. 1 pound of toxicant per 120,480 gallons of discharge.

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Table 7. Organophosphorus Insecticides for Use in Fly Control.

Type Application	Toxicant	Formulation	Remarks
RESIDUAL		(For 50 gallons of finished spray)	Add sugar (25 #) to formulation for maximum residual effectiveness. Spray surfaces at a rate of 2 or more gallons per 1000 square feet. Maximum strength permitted for Diazinon and ronnel, 1.0 percent, malathion, 5.0%.
	Diazinon	2 gal. 25% EC or 16 # 25% WP plus water	
	Malathion	2-4.5 gal. 55% EC or 32-64 # 25% WP plus water	Diazinon and ronnel can be used in dairy barns including milk rooms, meat packing, and other food processing plants.* Malathion can be used in dairy barns and meat packing establishments but in milk rooms and other food processing plants*, it is acceptable *only* when the premium grade material is used. None are accepted for complete interior treatment of houses.
	Ronnel	2 gal. 25% EC or 16 # 25% WP plus water	**Avoid contamination of human and animal food, watering troughs. Do not treat milk rooms or food processing areas while in operation.**
BAITS (Dry/Wet)	Diazinon	1 # 25% WP plus 24 # sugar; 2 fl. oz. 25% EC plus 3 # sugar in 3 gal. of water.	Apply 3-4 oz. (dry) or 1-3 gallons (wet) per 1000 square feet in areas of high fly concentration. Repeat 1 to 6 times per week as required.
	Malathion	2 # 25% WP plus 23 # sugar	Avoid application of bait to dirt or litter.
	Ronnel	2 pts. 25% EC plus 3 # sugar in 3 gal. water.	The use of permanent bait stations will prolong the efficacy of each treatment.
	DDVP	3-6 fl. oz. 10% EC plus 3 # sugar in 3 gal. water.	All toxicants except Dibrom are available as commercial baits which are labeled for use in dairies and, except for DDVP, in food processing plants.* None of these baits should be employed inside homes.
	Dibrom	1.0 fl. oz. 50% EC plus 2.5 # sugar in 2.5 gal. water.	
	Bayer L 13/59	1 # 50% SP plus 4 # sugar in 4 gal. water.	**Do not contaminate feed or watering troughs.**
IMPREGNATED CORDS	Parathion and Diazinon	To be prepared by experienced formulators only.	Install at rate of 30 linear feet of cord per 100 square feet of floor area. Accepted for use in dairies and food processing plants.* Handle and install cords per manufacturer's instructions.
SPACE SPRAY	Malathion	5 gal. 55% EC in 41 gal. water	Apply 20 gal. per mile.
	Diazinon	11 gal. 25% EC in 34 gal. water	Apply 15 gal. per mile.
	Bayer 29493		
	DDVP	6 gal. 50% EC in 44 gal. water	**Except for malathion none of these pesticides has been specifically labeled for outdoor space applications.**
	Dibrom		
LARVICIDES	Diazinon	1 fl. oz. 25% EC to 1 gal. of water	Apply 7-14 gallons per 1000 square feet as a coarse spray. Repeat as necessary, usually every 10 days or less. For chicken droppings use only where birds are caged.
	Malathion	5 fl. oz. 55% EC to 3 gal. of water	
	Ronnel	1 pt. 25% EC to 3 gal. of water	
	DDVP	2 fl. oz. of 10% EC to 1 gal. of water	**Avoid contamination of feed or water or the spray on animals.**

EC — Emulsifiable Concentrate WP — Wettable Powder SP — Soluble Powder

*Includes dairies, milk rooms, restaurants, canneries, food stores and warehouses, and similar establishments.

200:500 mg./sq.ft. or Diazinon-sugar formulations at a rate of 100:250 mg./sq.ft. has produced satisfactory fly control levels for periods up to 7 weeks. Results with Diazinon were consistent but control with malathion was erratic, effective abatement varying from 1 to 7 weeks in different tests. In other sections of the country, control data reflect shorter or longer periods of effectiveness for these two compounds.

Ronnel at 200 mg./sq.ft. provided excellent control of *M. domestica* for 8 to 9 weeks in dairies at Savannah, Georgia. At a dosage of 100 mg./sq.ft. with or without a sugar additive, the period of effectiveness was 4 to 5 weeks. At 20 mg./sq.ft. with or without sugar, control was ineffective within 1 week after treatment.

Studies of Bayer 29493 as a residual treatment in dairy barns at Savannah, Georgia, indicate it to possess excellent potential for extended control. When applied to dairy barns as an emulsion at a dosage of 100:250 mg. of toxicant: sugar per sq. ft. or at 100 mg./sq. ft. of toxicant alone, it gave 7 to 12 weeks and 7 to 8 weeks control, respectively. At 50 mg./sq. ft. with or without sugar, Bayer 29493 gave 6 to 10 weeks of effective control. In Florida, tests[A] with Bayer 29493 at 200 mg./sq. ft. gave good results for 4 to 5 weeks, and for 1 to 2 weeks at 100 mg./sq. ft.

DDVP, although highly effective against house flies, does not give extended control when applied as a residual treatment alone or with sugar or aroclor additives. After approximately 1 week of marked house fly reductions, densities usually return to pre-treatment levels.

In limited tests in Florida, Dibrom, a compound closely related to DDVP, has been reported[A] to provide good control for 1 to 2 weeks when applied at a rate of 200 mg./sq. ft. At a rate of 100 mg./sq. ft., Dibrom was ineffective after 7 days. At Savannah, Georgia, a single test of a Dibrom:sugar emulsion sprayed at 200:500 mg./sq. ft. produced satisfactory control for 3 to 4 weeks. Dibrom is labeled for use in dairies (except in milk rooms) and food processing establishments.

In some areas, house flies may be partially susceptible to one or more of the chlorinated hydrocarbon insecticides. Methoxychlor (200 mg./sq. ft.) and lindane (25 mg./sq. ft.) are the toxicants cur-

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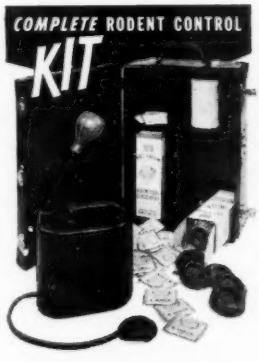

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rently labeled for use in dairy barns.

Residual treatments are effective against other flies that have resting habits similar to those of the house fly. The little house fly, *Fannia canicularis*, which frequently is a pest in chicken ranches and dairies, is readily susceptible to residual applications of dieldrin, ronnel and malathion. Dieldrin at a dosage of 25 mg./sq. ft. remains effective for extended periods, whereas the toxicity of malathion and ronnel deposits is relatively short lived. However, these last two compounds will control both *Fannia* and resistant *M. domestica*. Since both *Fannia* and *M. domestica* frequently rest out-of-doors on vegetation and exterior walls during hot weather, treatment should be applied to these surfaces as well as to the interior of the building. *In making applications on interior surfaces of chicken ranches, extreme care should be taken to avoid feed and water contamination.*

As part of the chemical control measures directed against flies and other animal pests in farm areas, dairy and beef animals are often treated with insecticidal sprays, dusts and dips. At present a number of insecticides are labeled for this purpose but since there are specific restrictions on dosage, type of formulation, application technique, and tolerances, the reader is referred to Agricultural Handbook No. 120, a yearly publication issued by the United States Department of Agriculture on insecticides in the control of pests attacking crops and livestock.

Impregnated Cords

The installation of parathion- or Diazinon-impregnated cotton cords in animal shelters has provided season-long control of *M. domestica* in the Savannah, Georgia, area. In other parts of North America, the duration of effectiveness has been less extensive but, except for relatively poor results reported from Arizona, the periods of abatement have been satisfactory. On California chicken ranches, tests with parathion-Diazinon cords gave 6 to 7 weeks of satisfactory control of house fly and *Fannia canicularis* populations. In British Columbia, parathion and Diazinon cords installed at a piggery maintained control of house flies for an entire season. Satisfactory control of *F. canicularis* in dairy barns also has been reported in Utah.

The installation rate for treated cords is 30 linear feet per 100 square feet of floor area. Data indicate that the 3/16" diameter cord is essential for season-long control with Diazinon, the smaller cord (3/32" diameter) yielding only 7 weeks abatement in dairy barns.

Experimental studies have been conducted with cords impregnated with ronnel and Bayer 29493. At Savannah, Georgia, 9 of the 10 dairies treated with ronnel-impregnated cords showed satisfactory control for 9 to 16 weeks. In Louisiana, ronnel- and Bayer 29493-impregnated cords installed in "pig parlors" yielded satisfactory control for more than 10 weeks. The treated cords were prepared by immersion either in a 25% xylene-ronnel solution; in a 12% emulsifiable ronnel concentrate; or in a 25% Bayer 29493 emulsifiable concentrate. Installation was at the standard rate. Ronnel is the first toxicant of relatively low mammalian toxicity to be suitable as a cord impregnant.

Field studies in Georgia utilizing Dimetilan bands showed reduced but unsatisfactory fly densities when the bands were installed at the rate of 6 linear feet of bands per 100 square feet of floor area. In a single test where installation was at the rate of 30 linear feet per 100 square feet of floor area, satisfactory to excellent control was obtained for the entire season.

Except for ronnel, the toxicity hazards of effective cord impregnants necessitate that the general public utilize only commercially prepared products which have been approved for use in dairy barns, chicken ranches and food processing establishments.

Poison Baits

Pesticides commonly employed in baits and labeled for use in dairy barns are malathion, ronnel, Bayer L 13/59, Diazinon, Dibrom, and DDVP.

The principal value of poison baits lies in their relatively low cost per treatment and in their immediate suppressive effect upon house fly densities. Bait treatments generally produce spectacular reduction of fly densities within a few hours, but such effectiveness is of short duration unless further treatments are made. Thus, the success of bait applications in controlling house fly populations depends on the diligence of the operator in applying the baits and in maintaining a reasonable degree of sanitation.

Permanent bait stations minimize the effort and time required for dispensing baits. This practice also provides for continual reduction of the fly population. Plywood trays (1 to 2 trays per 1000 square feet of floor area) are suitable for dispensing dry baits.

With liquid baits, a 1-quart chicken-watering container fitted with a cellulose sponge in the trough to prevent clogging by dead flies is an effective device. In field tests 36 dispensers installed at a chicken-hog farm resulted in satisfactory fly control for a 12-week period. Replenishment of the baits usually was required at intervals of 2 to 3 weeks or longer. DDVP at 0.1% in a 12.5% sugar solution is a suitable toxicant. With an experimental solid formulation of DDVP affixed to the base of the watering container, it was possible to replenish the bait by merely refilling the jar with sugar water as necessary.

Outdoor Space Sprays

Space treatments are utilized chiefly in situations where residual and larvicidal applications fail to give satisfactory fly control. As with mosquitoes, this type of treatment produces only a temporary effect on the adult populations; consequently at a site of heavy house fly production, such as a vegetable cull dump, repeated applications on a daily basis are usually required. Since the adult kill depends on contact with the insecticidal droplets, treatment must relate to the activity pattern of the flies. In addition, since the quantity of toxicant required per specimen is greater for flies than for mosquitoes, mist or dust applications usually are more suitable than fog treatments.

In recent studies in Georgia the effectiveness of six organophosphorus compounds was evaluated against caged house flies, located at sites 50, 100, 150, and 200 feet from the point of discharge. Water emulsion sprays were found to be more effective than dusts at comparable dosages. Malathion dusts (85-110 lbs., 12.5% concentration, per mile) applied at approximately 0.5 pound per acre (based on 200′ swath width) gave only an average 58% mortality of flies 50 feet from the point of discharge as compared with 99% mortality obtained under the same conditions with the water emulsion mist spray (9.5-10.5 gallons, 12.5% concentration, per mile). Diazinon sprays at a dosage of 0.3 pound per acre or higher gave essentially 100% kills at 200′ from the point of discharge. At a dosage of 0.2 pound per acre

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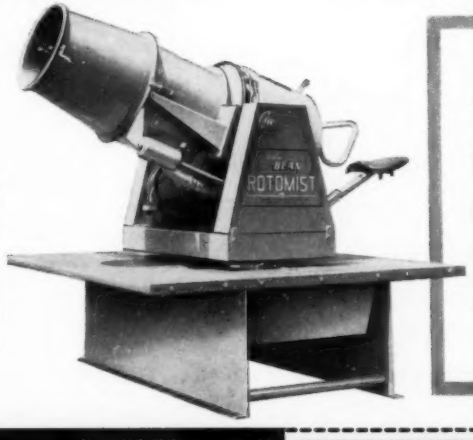

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(32 gallons, 1.5-2% concentration, per mile) water emulsion of Diazinon or DDVP were equally effective, giving 90 to 100% kills up to 100′ with decreasing mortalities at greater distances. Malathion at the same dosage and application rate gave average mortalities of 58 and 26% at 50 feet and 100 feet respectively. Dosages of 0.4 to 0.5 pound of malathion per acre usually were effective at 50 feet but beyond that distance were unsatisfactory.

Similar tests with Dibrom and Bayer 29493 revealed that the former gave good kills up to 200 feet at dosages of 0.3 to 0.4 pound per acre (17.5 gallons, 6% emulsion per mile) while Bayer 29493 was less effective, requiring a dosage of 0.4 pound per acre to give comparable kills at 150 feet.

Quick knockdown sprays, either hand or mechanically dispersed, are now being used to some extent by dairy and beef cattle farmers. Deodorized kerosene solutions of Diazinon (0.1%), ronnel (2%), malathion (2%) or synergized pyrethrin or allethrin (0.1%) applied with an electric mist sprayer against house flies in dairy barns produced 70 to 98% reduction within 10 minutes after treatment. However, most of the applications failed to produce more than 0 to 50% reduction 24 hours after treatment even when repeated daily for 5 days to 3 weeks.

Space applications of chlorinated hydrocarbon insecticides usually are more effective against resistant house flies than other types of treatment with the same compounds, but the cost of such partially effective operations frequently precludes their use on municipal programs. While organophosphorus compounds are effective against resistant fly populations, the relatively heavy dosages required and the higher costs of these pesticides lessen the feasibility of their usage as space applications on community fly control programs.

Larvicides

Of the various chemical measures employed against flies, larvicide treatment is an approach which frequently is least effective. In addition, the need for this type of application usually could be eliminated by proper attention to the basic foundation of fly control — *SANITATION*.

The poor performance of larvicides is usually due not to the toxicity of the chemical to the larvae but rather to the inability of the operator to apply the chemical so as to assure adequate contact between it and the insect. The composition of excrement, vegetable pulp, and other waste products is such that it is very difficult to obtain effective subsurface penetration of the pesticide. Improved penetration can be secured by reducing the concentration of the formulation and increasing the volume applied.

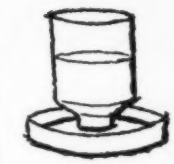
From the standpoint of initial kill and residual activity, Diazinon is the insecticide of choice as a fly larvicide. Other organophosphorus compounds (Table 7) also have value as larvicides. The maximum period of residual action is in the range of 1 to 2 weeks.

Studies in Florida[A] indicate that calcium arsenate sprays applied at 1 gram of toxicant per 1000 sq. ft. to chicken droppings at periodic intervals for 4 months gave erratic results. After some treatments, excellent control was obtained for 1 to 2 weeks, after other applications larval mortalities fell in the range of 50 to 75%.

Experiments indicate that the bacterium, *Bacillus thuringiensis*, produces a toxin which is lethal to house fly larvae. In Florida[A], feeding of caged chickens for 8 days with a 0.7% spore-mash formulation (70 billion spores/gram) did not prevent the development of fly larvae. In Kansas feeding of caged chickens for 18 days with a mash containing .01% *B. thuringiensis* (25 billion spores/gram) gave a 92% reduction in adult emergence from excrement seeded with fly eggs. Treatment of cattle feces with spores at 300 mg./kilo prevented larval development. At Savannah, Georgia, laboratory treatment of the fly breeding mash with *B. thuringiensis* (500 mg./kilo, 75 billion spores/gram) reduced adult emergence 95 to 100%.

For home use, paradichlorobenzene applied at a rate of 2 ounces per garbage can has been shown to give satisfactory control of fly breeding therein for 1 to 2-week periods.

Several pesticides are effective in the control of blow fly breeding in animal carcasses. One pint of 0.25% aldrin, endrin, or Diazinon emulsion applied to dog carcasses protected them from blow fly infestation for 26 to 30 days. Chlordane (0.5%), BHC (1% (15% gamma)), and malathion (0.25%) were less effective. In carcasses heavily infested with larvae 0.25% emulsions of endrin, Diazinon or malathion, or 0.5% emulsions of dieldrin or aldrin gave complete kills of full grown maggots, while



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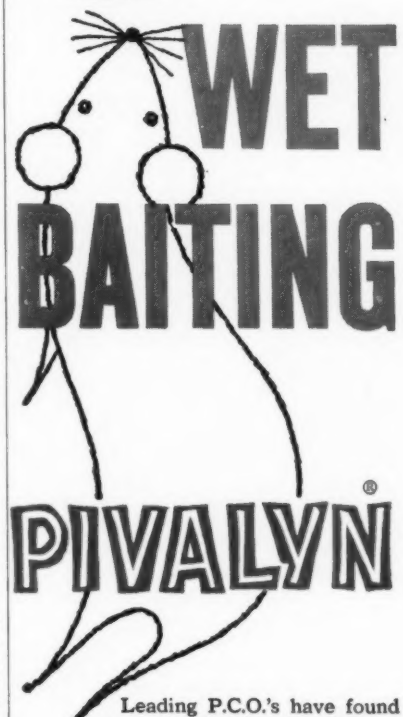

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concentrations of 2% BHC were required for effective reduction of the infestations.

FLEA CONTROL

Except for a single report of DDT resistance in *Xenopsylla cheopis* in India, the vector of murine typhus and plague continues to be susceptible to DDT. This toxicant remains the insecticide of choice against this species. DDT dust (5 to 10%) applied to runways and harborage areas of rats will give excellent control.

DDT is not effective in controlling dog and cat fleas (*Ctenocephalides canis* and *C. felis*) infestations in yards or on animals. Chlordane, although highly effective against these fleas, has in many areas failed to provide satisfactory control in recent years. In part the failure of chlordane to control these species is due to inadequate coverage of infested yard areas. In other instances, however, even adequate treatment has not given the degree of control desired. Although this lack of effectiveness reflects "practical" resistance of these fleas to chlordane, laboratory tests have failed to confirm such resistance. The fact that several organophosphorus toxicants have produced premises control of "resistant" flea infestations further suggests that these species are capable of coping with chlordane applications.

In parallel tests, yard infestations of dog and cat fleas have been controlled by treatment with 1% emulsion (1 gallon per 1000 square feet) of Bayer L 13/59, malathion, lindane, ronnel, and Diazinon. The latter three were most effective, eliminating the infestation for the entire 63-day observation period. Bayer L 13/59 and malathion gave effective results for 35 and 7 days, respectively. Chlordane was not completely effective, but at a strength of 5%, it produced a reduction of 84% for 63 days.

Flea infestations on dogs and cats can be controlled by treatment with malathion (3-5% dust; 0.5% spray), rotenone (1% dust) or synergized pyrethrum (0.2% dust). In addition, lindane (1% dust) or chlordane (2-4% dust) is suitable for use on dogs only. In most instances, pet treatment alone is not sufficient since the animal soon becomes reinfested from the untreated premises. Sleeping quarters, kennels, and other areas should be treated at the same time the animal is disinfested.

Table 8. Insecticides Commonly Employed in Roach Control.

Insecticide	Formulation	Percent Concentration
Chlordane	Spray	3.0
Dieldrin	Spray	0.5
	Dust	1.0
Diazinon	Spray	0.5[a]
	Dust	5.0[b]
Dicapthon	Spray	1.0[b]
Malathion	Spray or dust	1-5
Ronnel	Spray	2.0

a. At 1.0% for pest control operators only.
b. Pest control operators only.

ROACH CONTROL

Roach control difficulties relate principally to one species, *Blattella germanica*, which has developed resistance to chlordane in many areas of the United States. Although numerous organophosphorus compounds are effective against chlordane-resistant populations of *B. germanica*, none provide the long-term control characteristics of that insecticide. With the exception of a Diazinon-resistant strain from Kentucky, no resistance to organophosphorus pesticides has been confirmed in a field population. The Diazinon-resistant roach population proved to be susceptible to malathion. Compounds commonly used in roach control are given in Table 8.

In Florida, household tests in comparable dwellings with dusts of Diazinon (1%), and Dicapthon, ronnel, or malathion (4%) in pyrophyllite indicated Diazinon to be the most effective. It gave 87 to 94% control of German roaches during the 60-day observation period, with 77% control for an additional 30 days. Oil and water-based sprays evaluated over the same time intervals yielded 98 to 100% control, indicating these formulations to be more effective than the dusts. Roaches were observed to avoid dust deposits and seek areas where a dust could not be applied or would not adhere. Dusts, however, drifted well and could be utilized effectively in areas difficult to spray, such as the interiors of hollow walls, etc.

Field tests[A] with 1.0% solution or emulsion sprays of Bayer 29493 against *B. germanica* revealed these formulations to be equal in their effectiveness. Ninety days after treatment the reduction in infestation levels remained in the 80% range.

Laboratory tests with Sevin have shown that emulsions alone or synergized with piperonyl butoxide were relatively ineffective against resistant German roaches. However, a 5% suspension of Sevin gave 95 to 100% control for the 60-day observation period. At the same strength an emulsion formulation was ineffective.

With organophosphorus toxicants, residual activity has been shown to vary with the surface treated (e.g., Diazinon remains effective longer on materials such as wood or wallboard than on linoleum or glass). Also the control achieved with many of the organophosphorus compounds appears to be directly related to the completeness of coverage achieved. Staining problems may arise in treating certain types of surfaces such as wall paper, plaster, etc. Dicapthon should be used with caution, particularly on alkaline surfaces. Also, caution should be used when spraying oil-base solutions around asphalt or vinyl tile floors. Spillage on surfaces of this type causes a softening and surface marring effect.

Studies[A] with 3 silica gel formulations indicated that two formulations provided 72 to 95% control of German roaches for periods of 2 to 3 weeks. The third was ineffective. None of the formulations were as effective as Diazinon dusts, but two were superior to malathion. Special care must be exercised in applying the silica gels, otherwise the particles diffuse throughout the home.

Susceptible *B. germanica* and other species of roaches can be controlled with chlordane (3% emulsion or solution) or dieldrin (0.5% solution or 1% dust).

Application of any of these pesticides in households or in food handling establishments should be as a spot treatment, utilizing a coarse spray or a dust to treat baseboards, along water pipes, and in other roach harborage areas and runways.

To obtain a quick kill in heavy roach infestations or to drive the insects from protected recesses, the use of aerosol formulations of pyrethrum alone or in combination with a residual treatment is of value. Where a combination application is made, the irritation of the roaches caused by the pyrethrum activates them to the extent that a greater amount of the residual deposit is "picked up" by the insects. In laboratory tests[A], Dibrom, at 100 mg./sq. ft. was shown to give a rapid knockdown of susceptible *B. germanica* but its effectiveness as a residual deposit

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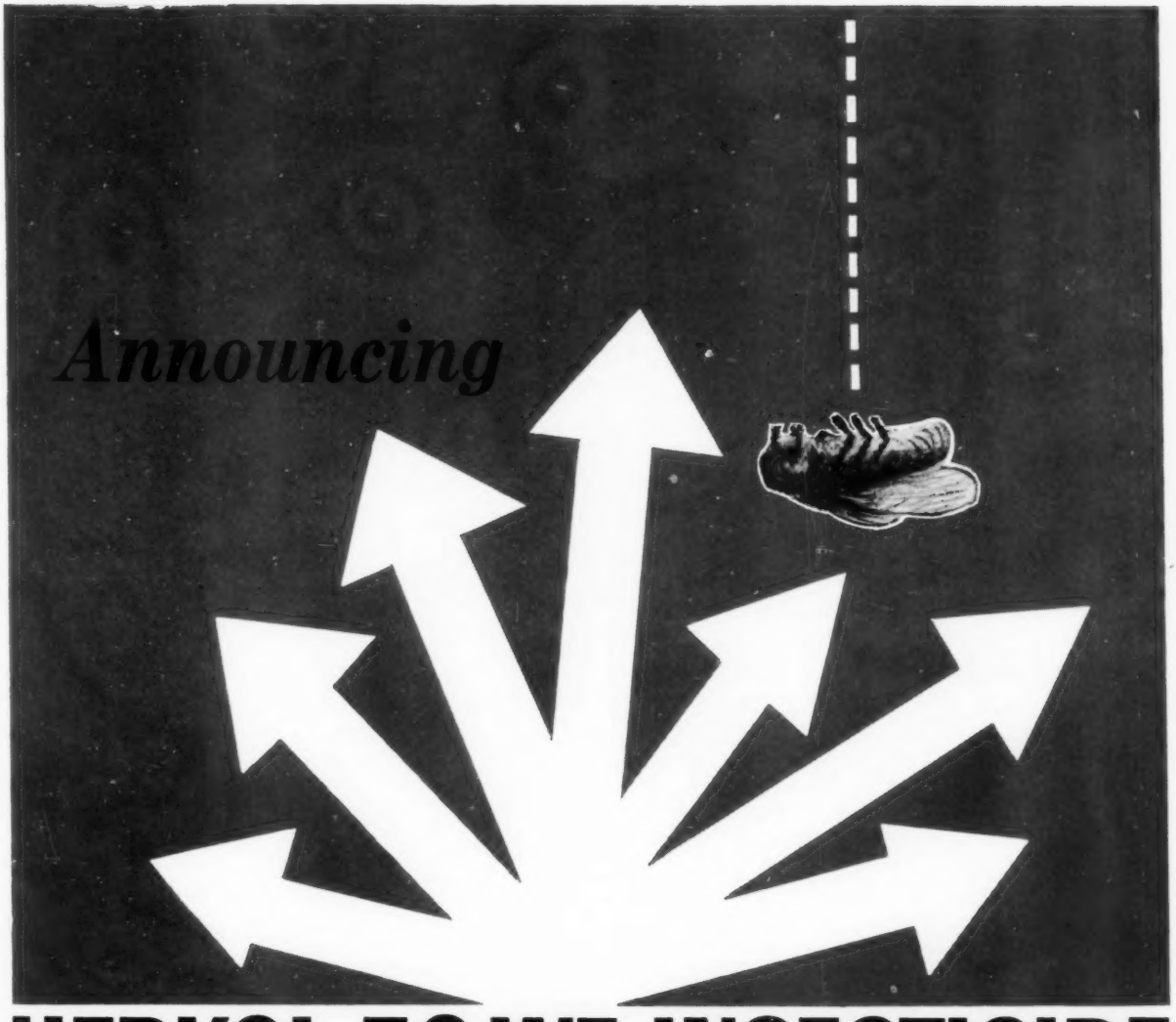

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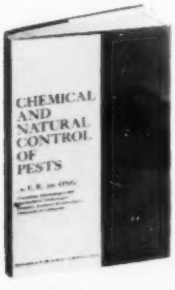

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was below that of chlordane at the same dosage.

BED BUG CONTROL

DDT remains the insecticide of choice for controlling the bed bug, *Cimex lectularius*, in homes in the United States. However, in other countries, spotted occurrences of resistance to DDT has been detected in both *C. lectularius* and *C. hemipterus*. Excellent control of susceptible populations usually is obtained by treating the baseboards, wall crevices, bedsteads, and mattresses of infested premises with a single application of a 5% DDT emulsion or solution.

To control DDT-resistant bed bugs, lindane (0.1% for beds and mattresses or 0.5% elsewhere), ronnel (1%), or malathion (0.5-1%) usually provide satisfactory results. When any one of these three toxicants is used, special care should be exercised in the treatment of mattresses and upholstery so that only a light application is obtained. *Under no circumstances should they be soaked with spray.* Where the infestation persists, retreatment may be made at not less than 2-week intervals. *Treatment of infant bedding, including the crib, should be avoided.*

Since bed bugs hide in cracks and crevices, the addition of pyrethrin (0.1-0.2%) to residual insecticidal formulations will increase the effectiveness of the treatment by stimulating the bed bugs to leave their harborage, thereby insuring better contact between the insect and the residual insecticide.

Synergized pyrethrin sprays (0.2% pyrethrin) alone also are effective against DDT-resistant bed bugs, but two or more treatments at intervals of 2 to 6 weeks may be required.

TICK AND CHIGGER CONTROL

The brown dog tick, *Rhipicephalus sanguineus*, frequently causes severe annoyance to man by invading the home and by infesting domestic pets. Since, in many areas, the species does not respond to control by the chlorinated hydrocarbon pesticides, the problem of ridding dwellings of infestation with this tick has increased greatly in importance during the past 2 years.

Studies in Florida[A] indicate that both Diazinon and malathion are effective against brown dog ticks. Either Diazinon emulsion (0.5%) or malathion in deodorized kerosene (1%) gave effective control (95 to 100%) in houses for periods of 12 weeks. A malathion emulsion (1%) was ineffective. Chlorinated hydrocarbon toxicants such as chlordane (3%), DDT (5%) and dieldrin or lindane (0.5%) are effective in controlling non-resistant *R. sanguineus* infestations.

In treating homes, the pesticides (except DDT) should be employed only as *spot treatments* to baseboards, floor and wall crevices, and other harborage sites. Careful attention must be given to treating the sleeping quarters of pets as well as the animals themselves. Dusts of lindane (1%), chlordane (2-3%), DDT (5%) and malathion (3-5%) can be applied directly to dogs; however, *neither Diazinon nor dieldrin should be used in treating the animal.* With severe infestations, it may be necessary to retreat both the household and dog.

Area control of ticks can be obtained by the application of DDT, chlordane, dieldrin, and toxaphene at rates of 1.0 to 2.0 pounds of toxicant per acre, or BHC at a rate of 0.5 pound of the gamma isomer per acre. Suspension, emulsion, or dust formulations of these pesticides produce similar results. The level of control secured is dependent on the adequacy of the coverage. In brush areas 50 gallons of spray or 40 pounds of dust per acre are required as compared to approximately half those amounts in sites of thin cover such as lawns, etc. Treatments with these chemicals usually prevent reinfestation for 30 days or more.

Area infestations of chiggers, such as *Eutrombicula alfreddugesi*, can be controlled with spray or dust treatments of toxaphene or chlordane (1 to 2 pounds per acre), lindane (0.25 or 0.5 pound per acre) or dieldrin (0.6 to 1.0 pound per acre). Application rates of 40 pounds of dust or 50 gallons of spray per acre may be required to insure thorough coverage of the area.

In treating woodland areas for either tick or chigger control, avoid application to ponds, streams, and to other water courses or to their adjacent margins since at the maximum dosages these pesticides (except lindane) are highly toxic to fish.

LOUSE CONTROL

Man is attacked by two species of lice, the body louse (*Pediculus humanus*) and the crab louse (*Phthirus pubis*). The crab louse and head louse (*P. humanus capitis*), a subspecies of the body louse, live on man continuously whereas the

body louse remains on the clothing except when feeding.

DDT (10% dust) and lindane (1% dust) have been used successfully in the control of the body louse, DDT being the insecticide of choice where louse populations have not developed resistance to it. Pyrethrum (0.2%) or allethrin (0.3%) synergized with sulfoxide at the rate of 1:10 also gives satisfactory results but the residual action of each is less than that of DDT. The latter and lindane are more suitable for mass treatments of individuals.

In certain areas, body lice have displayed a resistance to both DDT and lindane. Experimental studies with malathion indicate that a 1% powder is effective against both the adults and eggs of *P. humanus*. With 0.1% dust, adult lice were killed for periods up to 2 weeks. Toxicologic studies show that 1 to 5% malathion dusts were not harmful to humans treated 5 times per week (2-3 oz. per application) for periods as long as 12-16 weeks.

Louse powders should be carefully applied to the inside surface of the clothing, particularly the undergarments. Special attention should be given to seams and folds. Usually 1 ounce of powder will suffice for adequate coverage of an individual. Treatments can be applied to the clothed individuals or to the garments themselves.

As one treatment of DDT is effective for 3 to 4 weeks, it usually will control the infestation. With lindane, pyrethrum or allethrin dusts, a repeat application usually is required 7 to 10 days after the initial treatment to kill newly hatched lice inasmuch as these toxicants are not effective ovicides.

For combatting the head louse and public louse, two treatments (.05-1.0 oz. each) of 10% DDT dust applied to the infested parts of the body usually will eliminate the infestation.

RODENT CONTROL

The anticoagulant poisons have dominated the field of rodenticides for the past decade. These slow-acting rodenticides are preferred for use in most situations because of their effectiveness against rats and mice and their low degree of toxic hazard to humans and domestic animals. As yet, despite their widespread use, there is no field evidence to indicate the development of resistance to any anticoagulant rodenticide in field populations.

Rodents, like many insects, thrive under insanitary conditions which provide ample food and harborage. *To achieve permanent rat control, sanitation measures such as proper garbage disposal and food storage, harborage elimination and rat proofing must be followed diligently.* Rodenticides are supplemental to and not a substitute for sanitation.

Table 9. Rodenticides employed against roof and Norway Rats.

Rodenticide	Roof Rat	Norway Rat
Diphacinone[1]	50-100 p.p.m. (0.005-0.01%)	50-100 p.p.m. (0.005-0.01%)
Fumarin / Pival[1]	250 p.p.m. (0.025%)	250 p.p.m. (0.025%)
Warfarin[1]	250 p.p.m. (0.025%)	50-100 p.p.m. (0.005-0.01%)
Sodium monofluoroacetate (1080)[2]	3180 p.p.m. (0.318%)	3180 p.p.m. (0.318%)

1. May be used as dry or as liquid bait.
   Dilution factors: 250 p.p.m. =1 part of 0.5% concentrate to 19 parts of bait.
   100 p.p.m. =1 part of 0.5% concentrate to 49 parts of bait.
   50 p.p.m. =1 part of 0.5% concentrate to 99 parts of bait.
2. *For use only on certain types of premises by trained personnel.*
   Dissolve 12 grams of 1080 in 1 gallon of water.

Anticoagulant poisons include Pival, warfarin, Diphacinone, Fumarin and PMP; warfarin being used most extensively.

Dependable control of the Norway rat, *Rattus norvegicus*, and the roof rat, *R. rattus*, can be accomplished with the dosages of the rodenticides indicated in Table 9. Pival and warfarin appear to be equally effective against field populations of rats or mice. In simulated field tests warfarin as a solid bait was somewhat more effective than Pival but the latter as a water bait (0.006% acid equivalent) with 5 percent sugar additive gave results slightly better than a similar formulation of warfarin (0.005% acid equivalent). In situations where the species of rat is not known, the higher dosage (250p.p.m.) of warfarin or Pival should be used.

Laboratory tests comparing warfarin, Diphacinone, Pival and PMP against *R. norvegicus*, indicated the first three rodenticides to be equally effective and superior to PMP. Field studies of Fumarin indicate it to control commensal rodents at the dosages indicated in Table 9.

Investigations at Savannah, Georgia, have shown yellow corn meal to be the most readily accepted inexpensive bait material. It is suggested for use as the initial bait in rodenticide operations. If a baiting problem develops, other cereals can be tried. Such baiting problems usually are not related to the poison employed, but to the ecology of the rodent. Therefore, knowledge of the habits of the rodent is essential.

Under conditions where food is readily available to rodents at all times, e.g., in feed or food warehouses, none of the cereal baits may be accepted and the most productive approach will lie in the use of water baits. Anticoagulants in water, with 5% sugar as an attractant, will give good results if other sources of water are removed.

The effect of the anticoagulants is cumulative so that their rodenticidal action depends upon at least a small amount of the poison being consumed almost every day for several days. To achieve effective control, the anticoagulant baits must be continuously available to the rats for a period of at least 2 weeks. Establishment of permanent bait stations in places subject to reinfestation provides good continuous control. Experiences at Savannah, Georgia, have shown that Norway rats can be controlled by this means in non-ratproof buildings, but complete eradication could not be achieved because rats continued to enter from the outside. These bait stations were supplied with fresh bait approximately every 6 weeks.

Sodium monofluoroacetate (1080) is still the most effective, fast-acting rodenticide, but its extreme toxicity to man and animals requires that it be used only on certain types of premises and only by carefully trained crews. (See Table 9 for dosage). The precautions necessary for the safe use of 1080 are numerous and involved. They are described in the "Operational Memoranda on Economic Poisons".

Prior to the advent of the anticoagulants, red squill was the principal rodenticide. Meat, fish or corn meal baits containing 10 percent red squill continue to be of value in reducing populations of the Norway rat.

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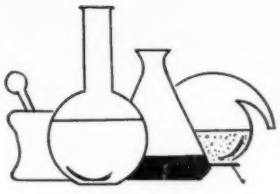

PURDUE UNIVERSITY, DEPARTMENT OF ENTOMOLOGY, WEST LAFAYETTE, INDIANA

Correspondence Course in Pest Control Technology

By DR. LEE C. TRUMAN*

Lesson No. 3

Insecticides (1)

THE TERM "insecticide" in the strict sense includes all chemicals used to kill insects. In a broader sense, and in common usage, the study of insecticides normally includes other materials such as repellents and attractants. Ideally, an insecticide would rapidly kill any detrimental insect exposed to it and would be completely harmless to man and his domestic animals. It would also be cheap and readily available in necessary quantities, stable chemically, non-inflammable, easily prepared and applied, non-corrosive, non-staining, and would have no undesirable odor. If such a chemical were available, the work of the pest control operator would be quite easy; there would be no need for him to know how to prepare and store his chemicals, or how to use them safely and in a way that is not objectionable to his customers. Unfortunately there is no such ideal material available so it is necessary for the pest control operator to know a great many things about the chemicals which he uses.

Insecticides enter the body in different ways: *stomach poisons* must be swallowed in order to kill the insect; *contact poisons* must penetrate or damage the body wall in order to be effective; and *fumigants* enter the body through the respiratory system or the body surface to cause death. Many insecticides are both stomach poisons and contact poisons, and some act as stomach, contact, and fumigant. Repellents cause insects to stay away from, and attractants induce them to come to treated surfaces.

Ant baits, phosphorus paste, certain mothproofing chemicals, and some dusts and liquids which the insect may introduce into its mouth are examples of stomach poisons. Such chemicals as hydrogen cyanide, methyl bromide, and chloropicrin are examples of fumigants. Pyrethrum, Thanite, chlordane, lindane, DDT, malathion, diazinon, ronnel, aldrin, dieldrin, and dicapthon are examples of contact poisons. Chlordane, lindane, and DDVP are examples of residual sprays which may also kill through the action of their vapors.

While residual insecticides are usually classified as contact sprays, they are a special kind of contact spray. In pest control work it is customary to use the term contact insecticide to refer only to those chemicals which contact the insect body directly while being applied. Thus contact sprays may be space sprays, aerosols, smokes and other such applications. The term residual insecticide is usually reserved for those chemicals which are applied in such a way that a crystalline or a film-like layer forms on surfaces where insects congregate or walk so that later contact with these treated surfaces will kill the insect. Some insecticides may kill by both direct contact and residual action. Thus DDT or chlordane will kill insects when sprayed directly on the body or when placed on treated surfaces from which insects will pick up a lethal dose at a later time. The same insecticides formulated as dusts also work in both of these ways.

Most insecticides which are available to the pest control operator come in concentrated form and, in the case of liquids, must be diluted to working strength in a solvent such as oil or water. In the case of dust concentrates, the concentrated chemical must be reduced to a proper working strength by the addition of another dust, or diluent, such as talc or pyrophyllite. Some of these additives or extenders have insecticidal properties of their own, although they are usually not toxic enough to give control by themselves.

The various insecticides and rodenticides used by the pest control operator are available in many different forms: as technical or unformulated material, oil solutions, oil solution concentrates, water emulsion concentrates, ready-to-use water emulsions, wettable powders, dust concentrates, and ready-to-use dusts. The most common practice is to purchase concentrates to be diluted with oil or water for use when needed. Although the various formulations can be used on a wide variety of jobs, each has its own particular characteristics which help determine which is the best to use in any given work.

TECHNICAL INSECTICIDES

Technical material is the chemical as it comes from the manufacturer; it is rarely applied in that form, but is utilized to make concentrates from which ready-to-use material can be formulated. Technical material is mixed with such solvents, emulsifiers, and diluents as may be necessary to produce concentrated formulations which in turn can be diluted easily to usable concentrations. Even in the preparation of such non-insecticide materials as poisoned bird seed, the technical strychnine or thallium sulfate is diluted with water before being added to the seed. The most direct common use of technical material is in the preparation of solid rodent baits where technical arsenic, thallium sulfate, zinc phosphide, or other poison is mixed with the solid bait for use. Even then the technical material is actually diluted by the bait material itself.

OIL CONCENTRATES and FINISHED SOLUTIONS

Oil concentrates are made by dissolving a high percentage of technical insecticide in a solvent which can hold this quantity in solution. This concentrate is then diluted with base oil by the pest control operator to get the proper concentration for use on the job.

Oil solutions of any given insecticide in the form of finished sprays will usually kill insects on contact more quickly than will other types of formulations. This is due in part to the fact that oils may aid the penetration of the insecticide into the outer waxy layer of the insect body wall. In addition certain oils are, in them-

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selves, fairly good insecticides. These solutions will also flow into cracks and crevices readily. Because they are non-conductors of electricity, oil solutions can be used with a considerable degree of safety around electrical installations although the operator must be careful, particularly around older wiring, that the solvents in his spray do not harm insulation.

Cautions to Observe with Oil Solutions

Oil solutions usually handle quite well in many types of spray equipment. The solvents in them, however, will frequently have an adverse effect on gaskets and hose linings so the operator must be careful to use materials for these parts which will not be easily broken down. Many materials, such as some dyes in fabrics and wallpaper, some synthetic fibers, linoleum, rubber, and particularly asphalt floor tiles, and some paints can be badly damaged by careless use of oil base insecticides.

By their very nature, solutions in oil will burn. Hence they should not be used near open flames or where there is any excessive heat. They also tend to have more odor than other formulations. Do not use oil solutions on green plants since the various solvents are toxic to them.

When applied to porous surfaces such as unpainted wood, wallboard, brick, stone, or concrete, oil solutions tend to penetrate deeply and thus carry a large portion of the active part of the insecticide below the surface where it will not be available to the insect. For this reason, another type of formulation should usually be used in such situations where penetration is undesirable.

When permitted to become cold, oil solutions, particularly concentrates, tend to drop the insecticide out of solution. The appearance of any appreciable amount of sludge in the bottom of a container indicates that at least a portion of the toxic material is no longer in solution and thus the percentage of the insecticide has been reduced. Whenever this happens, it is necessary to warm the solution to room temperature and stir until the sludge has been redissolved. In cases when it will not redissolve, the solution must be discarded. Oil solutions, both concentrates and ready to use, must always be stored in a warm place during cold weather. Care must also be taken to insure that they are not subjected to unusually high temperatures in summer.

EMULSIFIABLE CONCENTRATES

Emulsifiable concentrates permit chemicals which cannot be dissolved in water to be suspended in it so water can be used as the extending or diluting material. This is done by dissolving the toxicant in its usual solvent (normally an aromatic oil) and adding an emulsifying agent which makes it possible for small droplets of the solvent, carrying the toxicant, to remain dispersed through the water. The ingredients of an emulsion, therefore, are: water, oil (in which the insecticide is dissolved), and an emulsifier to aid the dispersion of oil in water.

Cautions to Observe with Emulsions

Some insecticides can be emulsified very well and will remain in suspension in water for a considerable period of time, while others will settle out relatively quickly. Emulsions can usually be remixed so that the dispersion is uniform, but this remixture will usually settle out faster than did the original emulsion.

The pest control operator must be careful, therefore, that emulsions do not separate in his sprayer or he may be spraying almost clear water when this separation has taken place. Generally it is good practice to discard any emulsion left in a sprayer at the end of the day, rather than letting it stand overnight, both because of separation and, in the case of pyrethrum and the organo-phosphate insecticides, because they may lose insecticidal effectiveness on standing in a water medium.

Emulsions can be sprayed without harm on many surfaces which would be damaged by an oil solution. The operator must remember, however, that an emulsion concentrate itself contains a certain amount of oil solvent which, even though mixed with water, may damage some surfaces. Remember also that many surfaces can be stained or watermarked with the water portion of the emulsion. After all, water is an excellent general solvent.

Emulsions likewise penetrate porous materials although not to the same extent as do oil solutions thus tending to leave somewhat more of the toxicant on the surface. Many emulsions, in properly diluted form, are safe to apply to plants; the percentage of active insecticide depends on the insect to be controlled.

They are non-flammable and safe for use near open fires and heat, but they are good conductors of electricity and must not be used around electrical installations.

WETTABLE POWDERS

Wettable powders are made by impregnating a usually inert powder with an insecticide and then adding a wetting agent so that the powder particles can be suspended in water. Suspensions are physically quite unstable and must have constant agitation to prevent the solid particles from settling out in a short time.

While the water from a wettable powder mixture will penetrate porous materials, the powder does not and thus most of the insecticide is left on the surface. This gives the greatest possible residue with any given insecticide but the powder itself is frequently quite visible and defaces the surface to which it is applied. Although this factor tends to limit the use of wettable powders in many indoor situations, there is generally a much smaller chance of injuring plants with wettable powders than with emulsions or solutions. It is often the most desirable type of formulation to use in situations in which ornamental plants and lawn areas are to be treated. It is sometimes desirable to use wettable powders indoors in areas in which the presence of powder on the treated surface is not objectionable.

Due to the solid nature of the particles in a wettable powder, this type of insecticide plugs up strainers and nozzles more rapidly than oils or emulsions. Frequently the pest control operator will remove the strainer screens from his equipment and thus have only the nozzle stoppage with which to contend.

DUSTS

Dusts are dry mixtures, usually of insecticide with inert powders, although some dry powders are used as insecticides without the addition of any other toxicant. Dusts are available as concentrates which may be diluted with additional inert material or as ready-to-use materials. Unless the pest control operator has suitable equipment for mixing dusts thoroughly, he should buy them ready to use. Inadequate mixing will produce a powder which does not have the same killing power in all portions of the batch.

The usual dusts are composed of fine particles, about 250-350 mesh, while silica aerogels have an extremely fine particle size of less than 400 mesh.

Dusts can be used on almost any surface without harming it, but visible dust will usually create an un-

sightly appearance. Due to their small particle size, dusts will float in the air and can be forced into cracks and crevices and around irregular objects where treatment with liquids would be impossible. They generally leave a good residual as long as they remain dry, but when they get moist, they may cake and become ineffective. Insecticides which are normally used as residual chemicals in oil sprays or emulsions, however, will frequently retain their effectiveness as dusts even after becoming wet.

Dusts may kill as stomach poisons, after being eaten by the insect as it cleans the dust off its body, by contact when the powder is placed directly on the insect body, and in the case of silica aerogels, by removing or penetrating the waxy covering of the body so that the insect will dry out.

Which Type to Choose

To choose the best insecticide for a given job, the pest control operator must first, of course, pick one which will kill the insect to be controlled. He must then decide how the insecticide is to be used. In a vaporizer, he might use technical material; for a space spray, an insecticide in oil; for long residual activity in a dry situation, a dust; for an ordinary residual, either an oil solution or an emulsion; for a surface application of a residual where appearance is not too important, a wettable powder.

It must be remembered that insecticides applied in any of these forms will usually kill by contact but, since it is not normally possible to contact directly all of the insects to be controlled, the residual effect has to be considered. If the surface to which the application is to be made is extremely porous, oil based chemicals will usually penetrate too deeply. Emulsions would be a better choice, and if a visible deposit on the surface does not matter, wettable powders would probably do a better job.

It is important to remember that a lot of trouble can be avoided by keeping the insecticides clean. It is good practice to strain all oil solutions or water or emulsions before putting them into a sprayer. Dusts must be kept dry and free of lumps so there will be no clogging of the duster. Lumps of wettable powders must be broken up before mixing with water so that there will be as little strainer and nozzle clogging as possible. When wettable powders are used, it is always best to use another container into which a small portion of water can be mixed with the wettable powder to make a thin paste or slurry. The slurry should then be placed in the remainder of water to be used with constant agitation.

The pest control operator should know and understand the toxic ingredients, mode of action, physical properties, and safety hazards of any chemicals he may use. Generally speaking, it is believed that pesticides in the same group have a similar type of action, although this is not always true. The exact way in which many pesticides kill is not known. Reference to the subject headings in this lesson will enable you to place a given chemical into a given group and thus to be able to obtain general information about it from various chemical and toxicological texts.

In this section are listed many of the chemicals commonly used by the pest control operator together with their common properties. In any case, where toxic chemicals are being used, the pest control operator should, in addition to the information contained here, ask his supplier for complete chemical and toxicological data on those chemicals which he is purchasing.

RESISTANCE

Before considering the properties and uses of insecticides, it may be well to mention briefly the important phenomenon which is generally called resistance of insects to insecticides.

Resistance is a rather general term which in the broad sense refers to the occurrence of a measurable lessening of the effectiveness of an insecticide. This means that within an insect population there is some change wherein the same amount of insecticide applied under comparable conditions does not kill as large a percentage of the population as had been the case previously.

The general public has become so familiar with the process by which immunity to disease is acquired through antibodies produced within the body following injection of a vaccine that this is usually the first thought which comes to mind when insect resistance is mentioned. This impression is quite unfortunate because this is not the way in which insecticide-resistant populations of insects arise.

Resistance is due to selection within the population; the insecticide is the agent of selection. To illustrate this situation, suppose that an insecticide is applied and that it kills 98% of the individuals which contact it, but there are 2% of the insects which survive the treatment. This "select few" which are naturally resistant to the insecticide then make up the entire breeding stock from which the next generation will arise. It is likely that this second generation, having had resistant parents, will include a larger percentage of resistant individuals than was present in the previous generation. When the same insecticide treatment is applied to this generation as was applied to that of its parents, a larger percentage of the second generation will survive. When this is repeated over a number of generations, it may require only a relatively short period of time before the majority of the members of the population will not be killed by the insecticidal applications. What has happened then is that an insecticide has acted as a selecting agent, killing those members of a population which are susceptible to the chemical and leaving those which are resistant to breed and produce subsequent resistant generations.

Resistance does not develop everywhere that a particular insect is found. It appears first in local situations and may become general throughout the geographical range of an insect both by continued development in new local situations or by migration of resistant individuals. Resistance develops fastest in insects which have high rates of reproduction and are able to move readily from one locality to another.

We have just discussed the normal type of insecticide resistance known as "physiological resistance." Sometimes insects exhibit another type called "behavioristic resistance." In such situations, they either avoid the chemically treated surface altogether or they will not remain on the surface long enough to pick up sufficient insecticide to kill them. When this type of resistance occurs, the solution to the control problem may or may not involve a new insecticide; it does require that you study the insect's habits and learn where to put the insecticide.

INORGANIC TOXICANTS

ARSENIC TRIOXIDE — As_2O_3 (white arsenic, arsenious oxide) is a heavy, white, odorless, and tasteless powder which is from 15-23 times more poisonous than DDT.* It is slightly and slowly soluble in cold water,

*DDT toxicity: This chemical is classified as a moderately toxic material, with an LD/50 of 200 mg/kg when applied orally in a single dose.

XUM

½ to 1% of the technical material dissolving in about 5 days. A higher percentage can be dissolved in boiling water, however, only ½ to 1% will remain in solution when the water cools. Arsenic trioxide and its derivatives (such as sodium arsenite, and calcium arsenite) are used in ant pastes, and in solid baits for snails and sowbugs. Arsenicals must be eaten to be effective and thus they are classified as stomach poisons.

SODIUM ARSENITE — Sodium arsenite is derived from arsenic trioxide and is a complex of 3 salts, the principal one of which is $NaAsO_2$. In addition to the use mentioned above, it has been used extensively in mothproofers and as a soil chemical for subterranean termite control. It is purchased either as a chemically impure grey powder which must be dissolved in water or as ready-to-use solution. Even though this material is normally designated as a stomach poison, it must be handled with care so as not to get it on the skin and clothing. It is extremely toxic to plants.

SODIUM FLUORIDE — NaF. Technical sodium fluoride is a heavy white powder which for commercial use is required by law to be tinted blue or green in order to prevent it from being mistaken for such things as powdered sugar or flour which it resembles in appearance. Although it is possible to dissolve about 4% sodium fluoride in cold water, its greatest use in pest control has been as a dust, either alone or in combination with pyrethrum, for the control of cockroaches. It very effectively kills insects while it is dusty but, after it has become moist, it has very little effect. It acts as a stomach poison and, to a lesser degree, as a contact poison against insects. Sodium fluoride is quite hazardous and must be stored and used so that not even a small amount will get into food or food containers. As little as 2 grams have been fatal in man, although 4 grams is a normal fatal dose.

SODIUM FLUOSILICATE— Na_2SiF_6 is also known as sodium "silicofluoride." It is a white, granular, odorless powder. About 0.67% will dissolve in cold water. This material is considerably more toxic than sodium fluoride and, like it, must be tinted blue or green for commercial use. It is used in solution for mothproofing woolens and as a dust for earwig and cricket control.

PHOSPHORUS — P is available to the pest control operator mixed with attractant materials to make a paste. These pastes are ready to use and must never be diluted with water because the phosphorus particles may settle out and create a fire hazard. Phosphorus paste is used to control rats and American cockroaches. It is extremely poisonous and must be used with great care. The operator must be careful not to get it in contact with his skin as such contact over a long period of time can cause serious malformations of the bones of the body.

THALLIUM SULFATE — Tl_2SO_4 (thallous sulfate) is available as a white, crystalline, water-soluble powder. It is extremely poisonous and must be tinted Nile green for commercial use. Approximately 5% will dissolve in cold water. The fumes from boiling solutions are poisonous and must be avoided. Solutions of thallium sulfate have a slightly acid reaction and should be prepared in enamelware, glass, or plastic containers. It is odorless and tasteless and thus is frequently used in rat baits and ant baits. It must be used with extreme care because it is not only rapidly toxic to humans when taken in large doses, but is *cumulative* in its action to the extent that poisoning can occur after repeated consumption of very small amounts of the chemical.

NATURAL ORGANIC INSECTICIDES

PYRETHRUM is a derivative of a flower which is one of the chrysanthemums. As an extract, it is a dark syrupy liquid which must be purified and standardized for insecticidal use. Due to its low toxicity to humans, it is commonly referred to as a "non-toxic" insecticide. It is available in a variety of concentrations: as a concentrate in both oil solutions and emulsifiable concentrates and also as a dust. It is actually a mixture of 4 toxic agents. On insecticide labels these are grouped and referred to collectively as pyrethrins. The pyrethrins represent a chemically unstable group which accounts for their short residual effectiveness. Pyrethrum is frequently combined with other chemicals which act as synergizers to increase its effectiveness.

ROTENONE — $C_{23}H_{22}O_6$ is a colorless, odorless, crystalline insecticide insoluble in water and only very slightly soluble in petroleum distillates. Rotenone is derived from a number of different plants and is sometimes referred to as derris or cubé. It is most frequently used as a powder, but sometimes in a spray.

SYNTHETIC ORGANIC INSECTICIDES

ALLETHRIN — is a synthetically produced material, the structure of which is very closely related to one of the 4 toxic agents of pyrethrum. Its properties are similar to those of the pyrethrins, although in direct comparison it can be shown that it is more toxic than pyrethrins to some insects and less toxic to others. Its principal use is as a "knockdown" agent.

LETHANE 384 — is a material containg 50% by weight of beta butoxy beta thiocyanodiethyl ether. It is a clear pale liquid readily soluble in ordinary base oils. It is used as a direct contact spray in the same manner as pyrethrum but has about the same degree of toxicity to warm blooded animals as DDT. Commercially, it is available as a dust concentrate and as a liquid concentrate for mixing with base oils.

THANITE — isobornyl thiocyanoacetate, is readily soluble in petroleum diluents and is about as toxic as pyrethrins to warm-blooded animals. It is closely related to Lethane. Commercially it is available as a concentrate for making dilute solutions.

NAPHTHALENE— $C_{10}H_8$ is a white, crystalline solid which volatilizes slowly at room temperature. It is used in the manufacture of moth balls and has some use in the protection of fabrics and garments from moth and carpet beetle damage.

CHLORINATED HYDROCARBONS

ORTHODICHLOROBENZENE — $C_6H_4Cl_2$ is a clear colorless liquid which is soluble in oil and most organic solvents. Orthodichlorobenzene has been used as an ingredient in many termite control chemicals. It has a useful degree of vapor toxicity.

PARADICHLOROBENZENE — $C_6H_4Cl_2$ is a white crystalline solid which volatilizes slowly at room temperature. It is soluble in kerosene, carbon tetrachloride and other organic solvents. It is the principal chemical in deodorant blocks and in moth cakes, flakes, and nuggets.

PENTACHLOROPHENOL — C_6H_5OH is a dark colored, flaky solid with a characteristic odor. Pentachlorophenol is used as a wood preservative and as a termite control chemical, usually as an oil solution or as an emulsion paste. It is highly irritating to the mucous membranes and must be handled with care

in order to avoid injury to the eyes and skin. It is also phytotoxic, that is will kill most plants.

BENZENE HEXACHLORIDE — BHC; 1,2,3,4,5,6,-hexachlorocyclohexane is a chemical containing 6 isomers.* Only one of these, the *gamma isomer,* is highly toxic as an insecticide. Benzene hexachloride itself has a heavy, musty, persistent odor and is used principally in agricultural insect control. Formulations of BHC are based on the percent of gamma isomer present.

LINDANE is the gamma isomer of benzene hexachloride, not less than 99% pure, and has virtually none of the odor of BHC. For this reason, it is more commonly used in household pest control. It is a white crystalline substance which breaks down in the presence of strong alkalis.

Lindane paralyzes most insects quickly. It has a shorter residual life than DDT, and possesses a useful vapor action. Unlike many other insecticides, it is stable in the presence of heat and can thus be applied through heat generators and still retain its efficiency. It is almost twice as toxic as DDT as an acute poison and only ¼ as toxic as a chronic poison. It is not stored in the body as is DDT.

DDT — dichloro-diphenyl-trichloroethane; 1,1,1 trichloro-2,2-bis (p-chlorophenyl) ethane. The technical grade of DDT contains approximately 75% of the above formula with the balance being made up of various impurities. DDT is a waxy powder which is normally quite stable. It is only very slightly soluble in water, but is readily soluble in various amounts in chlorinated solvents such as carbon tetrachloride, as well as in other solvents such as acetone, xylene, aromatic petroleum hydrocarbons, and kerosene.

Concentrates of DDT usually contain an auxiliary solvent to hold the DDT in solution since most of the usual solvents, such as base oils, will not dissolve a sufficient amount of DDT.

DDT is used as an oil base, water emulsion, water wettable powder, or as a dust. It is moderately toxic to warm-blooded animals and is quite toxic to fish when used as a mosquito larvacide.

METHOXYCHLOR; 1,1,1-trichloro-2,2-bis (p-methoxyphenyl) ethane. Technical methoxychlor, a compound closely related to DDT, is considerably less toxic than DDT to both insects and warm-blooded animals. It is usually used in situations where DDT would be too hazardous and is available in both oil and emulsion concentrates.

TDE; 1,1-dichloro-2,2-bis (p-chlorophenyl) ethane, also known as DDD, is a light colored granular solid which, although closely related to DDT, is less toxic to warm-blooded animals. It is also less toxic to most species of insects; however, it is commonly used as a mosquito larvacide. In such use it is less hazardous to fish than DDT.

CHLORDANE — Technical chlordane is a mixture of related chemicals containing 60 to 75% of a material known as 2,3,4,5,6,7,8,8-octachloro-2,3,3a,4,7,7a-hexahydro-4-7 methanoindene. This is an amber, viscous liquid which is readily miscible in kerosene and other organic solvents in any proportion, but is virtually insoluble in water. Chlordane dries as a resinous film and thus leaves a good residual deposit which is not depleted by the sloughing of crystals, but may be susceptible to soiling. It is somewhat volatile, however, the fumes from large applications in closed spaces can be hazardous. Chlordane is available as technical material, oil concentrate, emulsifiable concentrate, wettable powder, and dust. It is widely used for the control of a great variety of insects and as a soil poison in subterranean termite control.

HEPTACHLOR — 1,4,5,6,7,8,8-heptachloro-3a,4,7,-7a-tetrahydro-4,7-methanoindene, is a compound present in small amounts in technical chlordane. It is a more toxic compound then chlordane. It is also more volatile and exhibits significant vapor toxicity. The technical material is a soft, waxy solid with a slight orange tint. Technical heptachlor contains about 72% heptachlor and 28% related compounds (principally chlordane). It is soluble in kerosene and in a number of organic solvents. It may be used as an oil solution but is more widely used as an emulsion. Dusts, wettable powder, and granular formulations are available. Its most important use in pest control at the present time is in soil treatment for control of subterranean termites.

DIELDRIN — 1,2,3,4,10,10-hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-1,4-endo-exo-5,8 dimethanonaphthalene. Dieldrin is considerably more toxic than DDT and is particularly hazardous because of the fact that it is readily absorbed through the skin. It has a long residual life. Dieldrin is available as oil solutions, emulsifiable concentrates, wettable powders, and dusts. It is used to control a wide variety of insects which occur outdoors, as well as indoors, and as a soil poison in subterranean termite control.

ALDRIN — 1,2,3,4,10,10-hexachloro-1,4,4a,5,8,8a,-hexahydro-1,4-endo-exo-5,8-dimethanonaphthalene is closely related to dieldrin, although it is a more volatile compound. Its principal uses are agricultural, although it is used as a soil poison in subterranean termite control and has been used as a tracking powder for rats.

ORGANO-PHOSPHATES

MALATHION; 0,0-dimethyl dithiophosphate of diethyl mercaptosuccinate. Malathion is only slightly soluble in petroleum oils but is readily soluble in many organic solvents. Non-refined grades have a distinctive, unpleasant odor. It is relatively non-toxic to warm-blooded animals.

This chemical is used commonly for the control of insect pests on ornamental plants as well as for the control of German roaches, houseflies, mosquitoes, and fleas which are resistant to such chemicals as chlordane and DDT.

DIAZINON; 0,0-diethyl 0-(2-isopropyl-6 methyl-4 pyrimidinyl) phosphorothioate. This is a dark brown liquid miscible in petroleum oils, alcohol, xylene and acetone. It is of only moderate toxicity to warm-blooded animals and is effective against a wide range of household insects including resistant roaches.

DDVP; 0,0,-dimethyl 2,2-dichlorovinyl phosphate. This phosphate compound is a quite unusual material in that, although it is of some value as a contact residual insecticide, it exhibits vapor activity to an unusual degree. The vapor toxicity is so important that recommended dosages for insect control as well as computations of non-hazardous levels for humans have been based on the volume of the structure in which it is used. The normal rate is 0.5 grams of actual DDVP per 1000 cubic feet of space. Special federal

*Isomers are two or more compounds which are made up of exactly the same number of each kind of atom that is included in their structure and they differ from each other only in the arrangement of atoms. (It's like switching furniture in a room. There are many ways to place the furniture and the room looks different each time, but it's still the same furniture.)

labels have been approved for application of DDVP by pest control operators only. One label is concerned with the application of 0.5% DDVP emulsions or oil solutions on surfaces which may be infested with cockroaches, ants, silverfish, and various small flying insects. The other recommendation is for the use of 1 to 3% DDVP solution applied as a fog or a mist in normal space application equipment. Prolonged exposure to the vapors of DDVP should be avoided at time of application.

RONNEL; (Korlan; Trolene); 0,0-dimethyl 0-2,4,5-trichlorophenyl phosphorothioate, is a white to light tan solid which is insoluble in water, but readily soluble in most organic solvents including ordinary base oils. It is one of the least toxic of the organic phosphate insecticides and is available as an emulsion concentrate which is also suitable for mixing with oil. Ronnel has been used effectively in the control of resistant roaches.

DICAPTHON; 0-(2-chloro-4-nitrophenyl) 0,0-dimethyl phosphorothioate. This material is only moderately toxic to warm-blooded animals. It is soluble up to 25% in such solvents as xylene, and AR-50 but less than 5% can be dissolved in ordinary base oils. It is available only to professional pest control operators in oil or water emulsifiable concentrates. Its principal use has been in the control of resistant roaches. Dicapthon on contact with an alkaline surface may cause a permanent yellow stain, consequently care must be exercised when using it on or near carpeting, tile, marble, painted surfaces, furniture, terrazzo, and other such surfaces.

DIPTEREX; 0,0-dimethyl-2,2,2-trichloro-1-hydroxyethyl phosphonate, is of moderate toxicity to warm-blooded animals. It is readily soluble (13 to 15%) in water. Commercially it is available as a 1% sugar bait used for fly control, and as a water soluble powder which is used in the control of resistant roaches.

ACARICIDES

Acaricides are chemicals used specifically for the control of *mites* rather than insects. Most of the organo-phosphates also possess acaricidal properties.

ARAMITE; 2-(p-tert-butylphenoxy)-isopropyl 2-chloroethyl sulphite. This is used in mite control, having a quick kill and leaving a residual which is effective for about 7 days. It is available as wettable powder, emulsifiable concentrate and dust. It is not to be used on edible crops.

CHLOROBENZILATE; ethyl 4,4′ dichlorobenzilate, is used in the control of mites. It has a relatively low toxicity to mammals and is available as emulsifiable concentrate, wettable powder, and dust.

Appendix to Lesson 3

WEIGHTS AND MEASUREMENTS

Weights and measurements for insecticide formulations and dosages are expressed in both the metric and United States systems. Most scientific work is done in the metric system, or in a combination of the two systems, while most pest control operators are more accustomed to the United States system. For this reason, it is sometimes necessary to be able to convert the information found in the literature from one system to the other. Where temperatures are involved, they may be expressed in either the Fahrenheit or Centigrade scale.

TEMPERATURE

On the Centigrade thermometer the freezing point of water is 0°C and the boiling point is 100°C in contrast to the Fahrenheit thermometer where the freezing point is 32°F and the boiling point is 212°F. Temperatures can be converted from one scale to the other by using the following formulas.

To Convert from Centigrade to Fahrenheit

$$°F = (°C \times 9/5) + 32$$

Example: Convert 10° Centigrade to °F.

$$°F = (10 \times 9/5) + 32$$
$$°F = 18 + 32$$
$$°F = 50$$

50°F.

To Convert from Fahrenheit to Centigrade

$$°C = (°F - 32) \times 5/9$$

Example: Convert 149° Fahrenheit to °C.

$$°C = (149 - 32) \times 5/9$$
$$°C = 117 \times 5/9$$
$$°C = 65$$

65°C.

LINEAR MEASURE

U.S. Units		Metric
1 inch (in.)	=	25,400 microns (u.)
1 inch (in.)	=	2.54 centimeters (cm.)
1 foot (ft.)	=	30.48 centimeters (cm.)
1 yard (yd.)	=	0.91 meters (m.)
1 rod (rd.)	=	5.03 meters (m.)
1 mile (mi.)	=	1.61 kilometers (km.)

Metric		U.S. Units
1 millimeter (mm.)	=	0.03937 inches (in.)
1 centimeter (cm.)	=	0.3937 inches (in.)
1 meter (m.)	=	39.37 inches (in.)
1 meter (m.)	=	3.281 feet (ft.)
1 kilometer (km.)	=	3281 feet (ft.)
1 kilometer (km.)	=	0.6214 miles (mi.)

To convert: inches to centimeters, multiply the number of inches by 2.54

centimeters to inches, multiply the number of centimeters by 0.3937

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WEIGHTS

Avoirdupois		Metric
1 grain (gr.)	=	64.8 milligrams (mg.)
1 ounce (oz.)	=	28.35 grams (gm.)
1 pound (lb.)	=	453.59 grams (gm.)

Metric		Avoirdupois
1 milligram (mg.)	=	0.01543 grains (gr.)
1 gram (gm.)	=	0.03527 ounces (oz.)
1 kilogram (kg.)	=	2.205 pounds (lb.)

When it is necessary to convert ounces to grams, multiply the number of ounces by 28.35. To convert grams to ounces, multiply the number of grams by 0.03527.

AREA MEASURE

U.S. Units		Metric
1 square inch (sq. in.)	=	6.45 square centimeters
1 square foot (sq. ft.)	=	929 square centimeters
1 acre (a.)	=	4047 square meters
1 square mile (sq. mi.)	=	2.59 square kilometers

Metric		U.S. Units
1 square centimeter	=	0.155 square inches
1 square meter	=	10.76 square feet
1 square meter	=	1.196 square yards
1 hectare	=	2.471 acres
1 square kilometer	=	0.3861 square miles

U.S. Units		U.S. Units
1 square foot	=	144 square inches
1 square yard	=	9 square feet
1 acre	=	43,560 square feet
1 square mile	=	640 acres

CUBIC MEASURE

U.S. Units		Metric
1 cubic inch (cu. in.)	=	16.39 cubic centimeters (c.c.)
1 cubic foot (cu. ft.)	=	28,320 cubic centimeters
1 cubic yard (cu. yd.)	=	0.7646 cubic meters
1 cubic yard	=	202.0 gallons

Metric		U.S. Units
1 cubic centimeter	=	0.061 cubic inches
1 cubic meter	=	35.31 cubic feet
1 cubic meter	=	1.308 cubic yards
1 cubic meter	=	264.2 gallons

LIQUID MEASURE

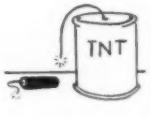
U.S. Units		Metric
1 fluid ounce (oz.)	=	29.57 milliliters (ml.)
1 pint (pt.)	=	0.47 liter (l.)
1 quart (qt.)	=	0.95 liter (l.)
1 gallon (gal.)	=	3.78 liters (l.)

Metric		U.S. Units
1 milliliter (ml.)	=	0.0338 ounces (oz.)
1 liter (l.)	=	2.113 pints (pt.)
1 liter (l.)	=	1.057 quarts (qt.)
1 liter (l.)	=	0.2642 gallons (gal.)

NOTE:
In common usage the terms **cubic centimeters** and **milliliters** are the same.

VOLUMETRIC MEASURE FOR POWDERS

Measure		U.S. Units		Metric Units
1 teaspoon	=	1⅓ fluid drams (fl. dr.)	=	5 cubic centimeters
1 tablespoon	=	3 teaspoons	=	15 cubic centimeters
1 fluid ounce (fl. oz.)	=	2 tablespoons	=	30 cubic centimeters
1 cup	=	16 tablespoons	=	237 cubic centimeters
1 pint	=	2 cups or 16 fluid ounces	=	473 cubic centimeters



APPROXIMATE VOLUMES OF GIVEN WEIGHTS OF SOME INSECTICIDAL MATERIALS

Material	Volume of materials equal to: one ounce	one pound
	Unit (level)	Cups
DDT, 100% Technical	3 tablespoons	2⅓
DDT, 10% Dusting Powder	3 tablespoons	3¼
DDT, 75% Wettable	5 tablespoons	5⅕
Dieldrin, 75% Wettable	4 tablespoons	4
Derris powder	6 tablespoons	6
Lindane, 75% Wettable	3 tablespoons	3¼
Naphthalene	5 tablespoons	5
Paradichlorobenzene	2½ tablespoons	2½
Pyrethrum powder	5 tablespoons	5
Soap powder	6 tablespoons	6
Sodium arsenite	1⅓ tablespoons	1⅓

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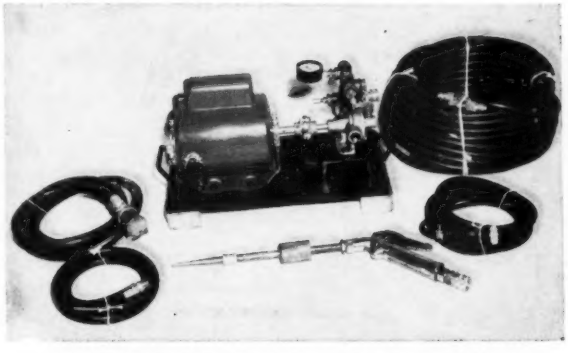

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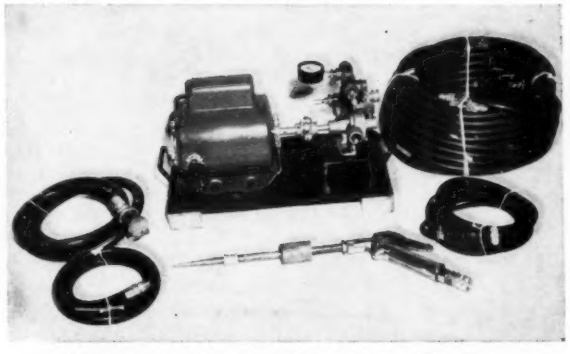

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dollars. Thus, William H. Ives, Rose Exterminator Co., Detroit, Mich., emphasized the importance of keen business management.

He said a well-managed company should have pre-planned goals with plans to reach those goals, company policies, an organized personnel, and coordination of all of its functions.

"Business goals should be consistent with personal goals: realistic, measurable, and expressed in terms of expected results," the Rose executive said. "Appraise sales and profit every year and match them to your long term goals. Use this to establish intermediate goals."

Profit Range, 7.5 to 13%

In order to know what to do and where to head, it is necessary to have facts that tell how money is being spent, according to Robert L. Showalter, NPCA executive assistant. He reviewed a survey of 1959 preliminary account classification records of 25 operators, which showed that the net profit of the participating firms ranged between 7.5 and 13%. This was in addition to executive salaries of 7.5 to 12%. Source of income from these 25 PCOs was 75% general pest control, 20% termite control, and 5% miscellaneous.

Expenditures were as follows:

Productive salaries	30-35%
Payroll burden (FICA, etc.)	5%
Material	10%
Auto and travel	10%
Building overhead and equipment	3-3.5%
Indirect overhead (supervisor's salaries, Etc.)	7%
Sales and advertising	6%
Office and administrative expense	16%

These figures can provide means of pricing work (three times labor cost). "They can also give each operator a goal within which to keep his expenses," Showalter explained.

Nixes "Half-Hearted" Training

Serviceman training should have many definite goals. So said Dr. Frederick McGuire, assistant professor of psychiatry, University Medical Center, Jackson. These include reduction of such discipline problems as tardiness, accidents, and illness, and the creation of better public recognition, improvement in general education, and improved public relations.

"Management is totally responsible for the training program," Dr. McGuire said. "If training is worthwhile, it must be backed with money. Half-hearted or partway training is useless."

Correspondence courses and on-the-job training are the two most

common teaching methods used in the pest control industry. On-the-job instructors must be carefully chosen; older productive men are not always the best teachers.

It is important when hiring to select a man that is trainable. He should understand what the standards are for the job he is seeking.

"Age is also an important factor. Twenty-five seems to be the age when most men settle down to do a good job for their employers," Dr. McGuire pointed out. "Occassionally, however, a younger man can be selected to grow into a job."

Dr. McGuire pinpointed employee morale as an important factor which can determine whether or not a business will prosper. A recent survey revealed the main goals employees seek in order of preference are 1. steady job, 2. comfortable working conditions, 3. good companions, 4. good boss, 5. opportunities for advancement, 6. high pay, 7. opportunity to learn, 8. good hours, and 9. easy work.

Make Bigger Pie

"People do not buy automatically enough to maintain our economy. You should view sales efforts as an attempt to enlarge the pie, not undercut competition for a bigger piece of the present pie." This is how Brice McEuen, vice president and director of Lamar Insurance Co., Jackson, explained the need to keep old customers as well as to gain new ones.

"Profit is not made on new business, but on continuous business," he said.

There are three types of salesmen. The first is stable; he is comfortable with present situations and is very close to his customers. No. 2 is ambitious; he uses his present job as a step towards something better. The third is unstable or mixed and is unable to adjust to new situations and cannot organize himself.

"Take a long look to determine what type of sales employee you want working for you, then hire him," McEuen recommended.

He said there is no substitute for face-to-face selling. Attention, interest and desire can be created by advertising, but it takes the personal contact to bring home a sale.

Report from NPCA

Progress in the NPCA's termite warranty program was outlined to delegates by Dr. Ralph E. Heal, NPCA executive secretary. He said two new features have been added to the program as a result of meetings at the 1960 NPCA convention. One allows the warranty to be written for a five year prepaid inspection guarantee, and the other allows the operator to delete the damage liability coverage on any particular job.

The association's technical director, Dr. Philip J. Spear discussed revisions of the Approved Reference Procedures for Subterranean Termite Control and received delegate approval to use Federal Housing Administration's Minimum Property Standards recommendations for materials and strength of emulsions.

Dr. Lee C. Truman told delegates how to make the most of the correspondence course being offerred jointly by *Pest Control* and Purdue University.

In addition to McKenzie and Redd, men responsible for conference arrangements were:

Program — Myron Smith, Hill-Smith Systems, Memphis, Tenn.; publicity — Clayton Wright, C. Wright Associates, Dallas, Tex.; booth exhibits — A. H. Jackson, Superior Termite Control, Jackson, Miss.; and finance — James Sims, Cardinal Pest Control, Montgomery, Alabama.

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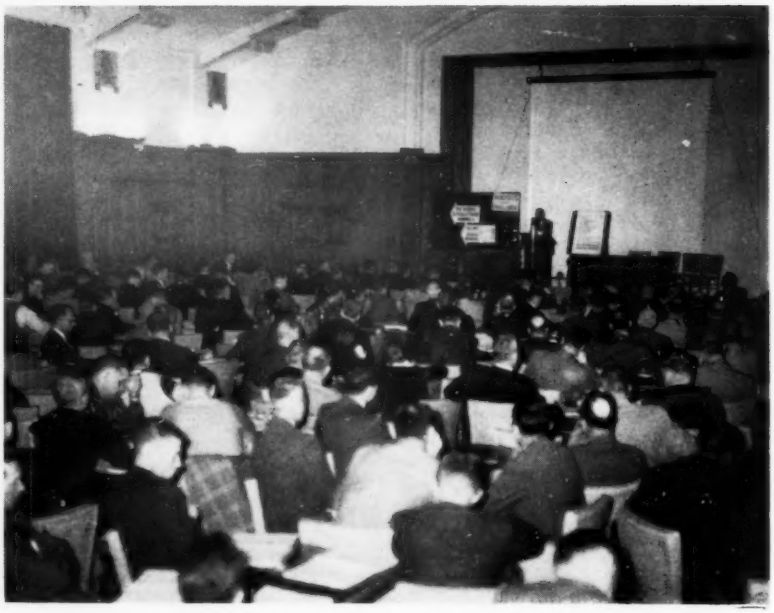
Future prosperity for the pest control operator on a "new frontier" of sanitation hinges upon his devotion to service. This was the challenge offered by representatives of food processing firms to 417 delegates at the 25th Annual Purdue PCO Conference in Lafayette, Ind., Jan. 23-27.

This year's Silver Anniversary meeting was sponsored by Purdue's entomology department, Dr. John V. Osmun, head, with cooperation from the National Pest Control Association.

Officials of a large cereal processing plant, a national bakery chain, and a granary all gave straight-from-the-shoulder advice on what they expect from PCOs.

Challenges in other phases of pest control were brought into focus by government and university specialists and fellow PCOs who enumerated opportunities in the relatively new fields of bird and



Road to Food Industry Business Paved with New Challenges, 417 PCOs Learn at Purdue Conference

ornamental pest control. There also were sessions devoted to the control of cockroaches, termites, and rodents, dusts, powders, and liquid formulations, training and communications, and safety.

"Food industry fortunes are now so closely allied with good sanitation practices that pest control cannot be placed in the hands of outside organizations that are unable to assume the liabilities that go with such servicing." So said W. W. Thompson, entomologist in charge of sanitation for Kellogg Co., Battle Creek, Mich.

He said thorough inspections by Food and Drug Administration agents, and strict regulatory measures, force the cereal industry to attain the nearest thing to total elimination of contaminating pests.

"This cannot be accomplished by food plant personnel alone. It requires teamwork by FDA inspectors, sanitarians, and management. A PCO possessing foresight and ingenuity can also become a member of this team," Thompson stated.

Formerly a manager for an Orkin Exterminating Company branch office, Thompson suggested that for an operator to rise up to this challenge, it is imperative he become a student of the many disciplines within the science of pest control.

"Modern sanitary standards make it mandatory for an operator to utilize services of educational institutions, research foundations, chemical companies, and governmental agencies for the knowledge that will make him professionally competent to handle problems the food industry is prepared to share with him," Thompson stressed.

Perfect record. Eight men attended every one of Purdue's 25 PCO conferences and seven of them were present to be photographed for the archives. Shown here are (left to right) Galen C. Oderkirk, Fish & Wildlife district agent at Purdue; Dr. George E. Gould, Purdue entomology professor; emeritus entomology department chief, John J. Davis; Rosemen Harlem Ives (Detroit) and Norman Dold (Chicago); and Purdue entomology professors Dr. Howard O. Deay and Dr. B. E. Montgomery. W. W. Scott of Arwell, Inc., was the other 25-yearer present but not when this picture was taken.

Need for PCO Consultation

Although his firm does not hire pest control operators for regular service work, J. Lloyd Barron, head of sanitation for National Biscuit Co., said there is a need for top-notch PCOs who can act as consultants and organizers of control programs.

"Actual service work can be performed as needed by plant labor working under plant sanitation supervisors, according to the program, materials, training, and inspection provided by a PCO consultant," he proposed.

Barron admitted Nabisco oc-

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cassionally engages a pest controller for some fumigation jobs, but that most of this work is also handled by in-plant personnel.

Good Sales, Bad Service

More frank than his colleagues, Lloyd Case, owner of the Northwest Malt and Grain Co., Chicago, criticized some pest control firms for having inadequately trained servicemen.

"When a salesman for pest control service talks to me I think, 'This guy seems to know what he's talking about.' After he sells us, he sends a serviceman who seems to be neither as qualified, or as informed, as the grain industry would have him be," Case spoke out.

He told delegates he would like to see well-trained servicemen armed with knowledge at least equal to that of their supervisors or salesmen.

Case also wants to see a closer relationship between PCOs and the grain industry in the treatment of railroad boxcars. He said he has suffered some embarrassing moments when rat and weevil infestations in boxcarred grain were brought to his attention by customers.

Case joined with Kellogg's Thompson to emphasize the need for PCOs to file written reports with industrial management in a concise, yet complete form, listing what work had been done, insecticides and rodenticides used, infestations found, locations of bait, etc.

"I am glad to see the pest control industry mature the way it has in the past 10 years," Case commented. "The grain industry stands to benefit from your continued growth."

Small local bakeries, just as their giant cousins, must maintain the best possible sanitary and vermin-free premises to make their businesses thrive, Jack F. Graves, owner of a small bread and pastry shop in Lafayette, reminded operators in his size-up of the PCO-baker relationship.

One suggestion he offered was that there be an extension of service to the outside perimeter of buildings to control mice. "If weeded areas surrounding small buildings are treated for mice, chances for an inside infestation would be reduced," he said.

Best compliment of the day came from Robert W. Bushaw, manager of the Van Orman-Fowler Hotel in Lafayette. He said operators have done a great job in his restaurant and hotel. "If hotels suffer from pest invasions, it's usually the owner's fault. Either he doesn't have a PCO working for him, or he isn't following the suggestions of the one who is," Bushaw explained.

Double-Edged Responsibilities

In answer to demands of pest controllers made by in-plant sanitarians, James W. Steckel, Tornco Pest Control Co., Columbus, O., likened the PCO-food industry relationship to a double-edged razor.

"For a razor to do a good job, it must be sharp. It will be even more economical if it is sharp on both edges," he reasoned.

Steckle told his fellow PCOs the challenge presented by big business is very clear and "we can't afford to offer less than it is entiled to and has a right to expect." A service package he proposed operators might offer would consist of 1. a comprehensive service and survey report, 2. environmental sanitation service, 3. weed control, 4. bird control, and 5. fumigation.

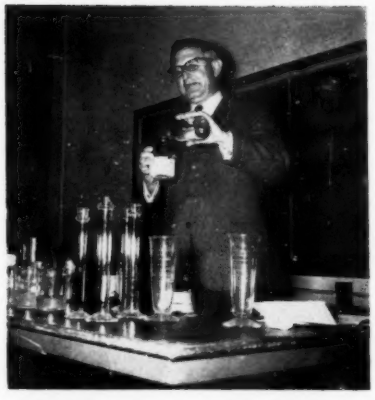
"In order to give industry these services, and any others it may want, PCOs need greater education, more technical training for servicemen, standardized procedures, increased supervision, modernized equipment, and more support in research areas," the Ohioan said.

Significant to food plant insect and rodent control is the proper use of toxic chemicals. In many situations PCOs are not permitted to use anything but the least toxic of pesticides, pyrethrum. Yet, resistance has forced this industry to employ stronger toxicants wherever they're permitted. Aside from the use limitations dictated by FDA and other laws, there are built-in headaches with the newer chemicals.

Formulations and Insurance

An 80% increase of property damage insurance rates during recent months has focused attention on the use of proper insecticidal formulations. Heavier dosages required to combat resistance have brought with them the formation of sludge in the bottom of equipment tanks and deterioration of hose. Such foreign refuse rides out with the spray to stain surfaces being treated. Greater percentage concentrations also have a built-in potential staining hazard.

Problems associated with the application of liquid formulations were aired by Herman Fellton, president of Getz Exterminators,



Stability of various types of formulations were demonstrated during Herman Fellton's lecture on using pesticides advantageously.

Atlanta, Ga. He explained the physical and chemical structure of suspensions, emulsions, and solutions and reminded delegates that the disadvantages of one type of formulation can be used to advantage if applied in situations which utilize its inherent characteristics.

Stressing the importance of particle size, Mr. Fellton demonstrated with simple beach sand and a carefully formulated wettable powder in water how small particle size insecticides stay in suspension longer than those with larger particle sizes.

When it comes to emulsions, the speaker recommended that a Diazinon water wettable solution should not be mixed days in advance of actual use. Rather an entire batch should be applied the same day it is put together. DDVP apparently has even less store-over time. This newer phosphate in a water wettable solution should be applied immediately after mixing to insure maintenance of its intended insecticidal activity.

Among other outside influences on water based formulations is the hardness of water. The harder it is, the more difficult it is to establish a stable emulsion. And base waters do not hold emulsions as long as water that is higher on the acid scale. The effect of various emulsifiers and temperature also influence the stability of emulsions.

Which formulation to use depends upon the particular toxicant involved, the pests to be controlled, type of treatment required, kind of surface to be treated, and the potential staining hazards, animal and plant toxicity, odor, and cost.

By example the speaker mentioned that DDT is a better insecticide to use on carpeting than chlordane since the latter leaves a slightly oily residue that makes the floor covering get dirty sooner. DDT does not have this tendency.

Choice of formulation likewise depends upon the application method to be used, be it a wettable overall residual, spot residual, or space spray.

Influential to the proper use of chemicals is the kind of equipment in which they are to be dispensed. The particle size flexibility of sprayers, aerosols, and misters, either manual, mechanical, or automatic, is important to the proper end use of the correct insecticide without causing damage. Only increased observance of all these variables is going to help bring down the soaring insurance costs that accompany the greater number of damage claims underwriters are having to pay since resistance is forcing the use of stronger toxic pesticides.

Still heading the list of resistant insects trying PCO skills is the German cockroach. And the habits of other roaches seem to be changing. To up-date delegates on the whole subject of roach control, Purdue programmed this topic as its pest of the year.

Roach biology and how it is related to inspections and control was the topic of a classroom session by PCO-entomologist, Dr. Lee C. Truman, Pest Control Services, Inc., Indianapolis, who told his students that a full understanding of each roach species is basic if these insects are to be controlled effectively.

How to classify and identify cockroaches was explained by Dr. H. O. Deay, veteran Purdue entomology professor at a microscope-laboratory session.

As if this industry doesn't have enough problems with resistance resulting from physiological changes in German roaches, behavioristic resistance is cropping up in new areas of the country. So said Clayton Wright, of C. Wright Associates, Dallas, Texas, who is chairman of the Technical Committee of the National Pest Control Association.

"We have reports that the German roach is beginning to move to the outside of houses in sections of the country where this never happened before," the Texan stated. "This is a change in the roach's habits that is intensifying our problems."

German roach activity outside homes has been reported in Memphis, Tenn. "This apparently indicates that roaches which cannot tolerate materials we use avoid

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NPCA technical committee chairman, Clayton C. Wright (left) spoke on the effectiveness of new roach chemicals. Here Logan Hines, Ohio PCO, seeks clarification on a point.

them by changing their living habits," he suggested.

High Praise for DDVP

One material which promises to alleviate the roach-resistant woes of PCOs is the vapor-emitting DDVP. Wright had high praise for this chemical which he helped test last summer as chairman of the NPCA Insecticide Committee, in several Dallas homes. "This is the first chemical a PCO can use as a residual spray and still get a fumigant-like action from it," he pointed out.

Field studies with DDVP, as well as laboratory experiments at Purdue, have shown the insecticide to be good for indoor insect control, but because of its quick dispersion properties, it gives little hope of controlling pests outdoors. This was a conclusion in a summary given by William L. Butts, Purdue entomology instructor who spent almost a year testing the chemical.

He said DDVP proved to be the best insecticide to control fleas in several Lafayette homes last summer where infestations were so heavy that dozens of the insects leaped onto the socks and pantlegs of the researcher when he entered their basements.

We sprayed the basement and first floor at 500 milligrams per 1,000 cubic feet covering baseboards, cracks, and corners," Butts explained. "We returned 12 hours later and found no fleas."

In one home Butts used the chemical as a fog and obtained the same good results, but when the homeowner's dog was allowed to re-enter the house, a reinfestation occurred. In all homes, DDVP gave excellent flea control, Butts reported, but its lack of residual leaves something to be desired.

For laboratory tests with DDVP on German roaches, Butts constructed a wall void with 2 x 4 studding and masonite to simulate a typical wall section in a house. Roaches were suspended in a pouch-like cage in the void at various distances from the bottom to determine how far up the chemical's vapors would travel to give 100% kill.

Using a dosage of 78 milligrams per cubic foot, DDVP was applied at the bottom of the 8 ft. void. Vapors climbed to 7 ft. to kill the test roaches. Butts reminded delegates, however, that air currents inside a void will cause some variation in the distance DDVP vapors travel. Downdrafts might keep the vapors from rising more than half way.

"There is still a lot to learn about what goes on inside a wall and I plan to modify this test panel so I can study the movement of roaches inside more thoroughly," Butts promised.

Results of outdoor tests with DDVP on flies were almost in direct contrast with those of the indoor experiments. The researcher-teacher said outside fogging gave very little, if any, control. "Apparently flies sense something is wrong when they land in a fogged area and are able to get up and fly out of the cloud before the chemical kills them," he said.

In barns and sheds DDVP gave good fly control because still air retained the vapor chemical so it was not quickly dispersed to the outside, Butts added.

One PCO asked if experiments showed DDVP affected the egg

Insecticide brass included Col. F. W. Whittemore (left), William L. Butts of Purdue, and Shell's Dr. Ralph F. Glasser (right), who talked formulation techniques and DDVP.

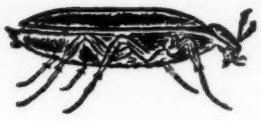
sack, or ootheca, of the female roach. Butts said current tests did not show this, but he does plan to look into this during 1961 experiments.

He reminded conferees his tests were conducted according to recommendations contained on DDVP's old label which restricted its use to 500 milligrams per 1,000 cubic feet. Since then, this limitation has been lifted by the U.S. Department of Agriculture and now a .5% solution or emulsifiable concentration may be used by PCOs.

"Be cautious of what to expect from DDVP," Butts warned. "There is still a lot to know about this promising chemical."

According to Dr. Ralph Glasser, chief chemist of Shell Chemical

"New insecticide my eye! I know bourbon when I smell it."



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Corp., the most important physical property of DDVP is its high vapor pressure that makes it "excellent for roach clean-out jobs and for treating hard-to-get-at places."

"Dr. James Grayson at Virginia Polytechnic Institute ran tests with German roaches and found 0.2% DDVP to be 100% effective for 15 days," the Shell representative related. "When 0.3% dieldrin was added to the DDVP solution, control was extended to 30 days."

This vapor active chemical, he said, is safe when used according to label instructions and there is no need to evacuate homes, restaurants, or other small structures when DDVP is being applied. He did suggest that if a large plant or warehouse is to be fogged with the pesticide, personnel should be asked to leave.

Losing Pesticide Fight

Organic phosphates, one by one, will fall victims to the development of resistance in German roaches, predicted Dr. Donald G. Cochran, VPI entomologist. Because of this and because he feels more insect species will develop increased tolerance to insecticides, Dr. Cochran said there will be a greater research effort to find new and different control chemicals. Now over 140 species are resistant.

Progress of VPI resistant roach studies was described by VPI researcher Dr. Donald G. Cochran (right) during a session chaired by Steve Ritt, (left) Philadelphia PCO.

Researchers at VPI have learned that an insect which becomes resistant to one chemical, automatically develops resistance to insecticides closely related chemically.

"This is shown clearly in the chlorinated hydrocarbon group where a cockroach resistant to chlordane is also immune to aldrin and dieldrin," Dr. Cochran explained.

The Virginian's report was not all gloomy, however. He said so far tests show this cross-resistance will not affect the organic phosphate chemical group.

"While limited resistance to Diazinon has been confirmed in our laboratory, so far we cannot find that these resistant roaches have developed a tolerance to other chemicals in the OP family," Dr. Cochran said. "I feel that eventually roaches will build up resistance to the phosphates, but if we use these insecticides wisely and to their very end, it will be a long time before all become useless."

He urged operators not to change from one organophosphate to another until it is absolutely necessary "so we don't waste insecticides."

Can an insecticide which becomes of little value because of resistance, be effective again after its use has been suspended for a period of time? This has been a question frequently asked since the discovery of insect resistance," Dr. Cochran admitted.

"We tried this with DDT resistant, lindane resistant, and chlordane resistant strains and found that roaches lost their defense against DDT after four generations in males and eight gener-

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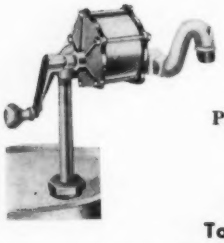

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On all chemicals read directions and cautions before use.

ations in females," he explained. "When the chemical was put back into use, resistance developed slowly, but it did develop."

Chlordane resistant roaches never completely lost their resistance even after 30 generations, and when the chemical was used again, it took only two strains to reach the original tolerance level. The same pattern followed in the lindane strains.

He disclosed that a discovery in his VPI lab revealed a roach strain not only resistant to DDT and methoxychlor, but also resistant to the carbamate, Sevin. "This is one cross-resistant study that is being investigated further," he said.

The once almost lost art of dust and powder application is fast becoming a most important part of roach control. Since resistant roaches have pest control and chemical experts admittedly baffled, PCOs are returning to dusts to supplement liquid sprays to get better control.

This is why Arthur W. Gibson, of Vogel-Ritt, Inc. of Ohio, Cincinnati, an artist with dust applicators, spent an afternoon demonstrating proper use of dust formulations and equipment.

"Servicemen cannot learn dusting techniques in an hour or a day," Gibson stressed. "They will have to practice on old shelves and cabinets until they learn how to handle the equipment without leaving a powdery trail after them."

He showed how to use the Central Rubber Co.'s bulb duster, the Getz blower, Dri-Die applicator, and the H. D. Hudson "Bantam" hand blower, all of which he labeled good for dust and powder jobs.

"A collection of this equipment might make a serviceman look like a 'Rube Goldberg' to his customer, but they all do the job," he quipped.

He emphasized the importance of using a flashlight when dusting to watch where the powder or dust is falling. To stress what can happen when a serviceman is not aware of this, Gibson related an incident which cost one company more than $100.

"Its serviceman was dusting along a baseboard of a drug store and shot some dust into a hole around a water pipe which led to the basement. It just so happened that directly under the hole there was a fan aimed at a table on which food was being prepared for the store's luncheon menu. There's no need to go on. You know what happened. The food had to be replaced."

WARF's antiresistant compound was briefly reported by Purdue chemist, Dr. Daniel L. Shankland (left) during an insecticides panel moderated by W. L. Brehm, B & G Co.

Where can dusts be applied in the home? In kitchens, apply dusts behind cabinets, under the sink, behind the stove, and in open cracks along the baseboard. In bathrooms, dust cracks around the medicine cabinet, but not inside. Behind bedroom dresser drawers and in the many ledges of furniture framework are other good areas to "poof" dusts.

Gibson cautioned delegates not to apply powders to damp areas or in spots which may become damp after treatment. Dust chemicals lose their killing power when they contact moisture, he explained.

Several dust formulations were described by Gibson who recommended the silica aerogels for good control. He said silica dusts are less hazardous than some other dusts, but provide the same kill.

Here are some of the dust formulations Gibson has analized as well as his comments about their use:

Sodium fluoride by itself can kill most insects, but is very toxic and must be applied with caution. It is important this dust be colored blue to eliminate the chance of mistaking it for flour. It gives good control of roaches.

Sodium fluoride and Pyrophyllite (Pyrox A) at a 50-50 mixture by volume. This dust formulation adheres to a roach's body quicker than sodium fluoride alone. It offers faster kill and does not break down.

Pyrethrum powder is good for flushing roaches, but it has a repellency that tends to drive roaches away. This may work to an advantage however, because it stimulates the insects and promotes enough activity to make them track through the powder.

Diazinon at 2% is good for chlordane resistant roaches.

Dieldrin granules at 1, 2, 5, and 10% are good for application out-of-doors to control roaches and other insects.

Chlordane dust at 5 and 10% is good for roaches other than the resistant German species.

Silica aerogel, 50% and Pyrophyllite, 50% by weight is a very good formulation for restaurant kitchen use because it has low toxicity.

The dust expert warned owner-operators who expand their dusting operations to be sure to re-evaluate jobs before signing contracts. He said more time will be spent on a service stop when dusts are used. "In some cases operators may have to charge 40-60% more for cleanout jobs because of the increased time on each stop," Gibson estimated.

Antiresistant for DDT

Apparently conditioned to past failures of so-called miracle cure-alls, delegates withheld victory cries over an announcement of a new chemical developed by the Wisconsin Alumni Research Foundation which is said to be the answer to DDT resistant houseflies.

Purdue toxicologist, Dr. Daniel L. Shankland told about the discovery of "WARF Antiresistant for DDT" and gave delegates a rundown of reported preliminary tests of the compound on both resistant and susceptible houseflies.

He said the new compound is claimed to inhibit the enzyme DDT dehydrochlorinase and thus interferes with the insect's ability to protect itself. Laboratory tests conducted by WARF researchers were made with CSMA non-resistant strains and Fowler DDT resistant cultures. In a contact spray test, 2% DDT gave 43% kill of houseflies, but when 0.2% Antiresistant was added to the 2% DDT, 90.5% of the insects were killed.

Tests indicate that when higher levels of DDT are used, smaller amounts of Antiresistant are required, while lower levels of DDT may require more Antiresistant. "Data, however, is perhaps still too sketchy to justify such a conclusion," Shankland explained.

He said that after nine generations of houseflies have been tested, no signs of increased resistance to the new compound was said to have been noted. "It is not expected that this new chemical can control insects that have always been resistant to DDT, such as grasshoppers, but only those which have once been susceptible and have developed a resistance," Dr. Shankland emphasized.

To see what effect Antiresistant would have on DDT resistant mosquitoes, WARF researchers tested

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Ronald McIntyre, chief engineer for Cooper, McDougald & Robertson, Ltd., Berkhamsted, Herts., England, adjusts the 12-foot instrument panel on the new type pyrethrum extraction unit which his company installed in the Newark, N. J. plant of Prentiss. The unit, which employs a tripe distillation process, is the first of its kind to be installed in the United States.

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William O. Buettner, first NPCA executive secretary was awarded one of Purdue's Distinguished Achievement citations in 1953 before he died. Shown here with the new plaque that hangs in the school's Memorial Center are his widow Helen, his son, Teddy (center), and Prof. J. J. Davis who was instrumental in having the university recognize this industry pioneer.

female adults of *Aedes aegypti*. A dosage of 25 micrograms of DDT in glass vials gave 24 hour mortality of 35% of the mosquitoes after 30-minute exposure. A combination of 25 micrograms of DDT plus 25 micrograms of the ethyl analog of Antiresistant, gave 95% kill.

Against larvae of the same mosquito strain, 0.5 p.p.m. of DDT in water gave a 15% kill, while 85% kill was obtained by adding 0.5 p.p.m. of ethyl analog Antiresistant to the water.

"Results of residual studies on plywood panels with *Aedes aegypti* adults have not proved satisfactory," according to the WARF report. "Current work on *Anopheles quadrimaculatus* on the other hand, appears to be favorable. Further work is being conducted on this project."

Dr. Shankland's skeptical summation of the WARF research report explains why there were no victory cries over the new discovery. He pointed out that the DDT resistant flies used in these tests were only 62½ times as resistant as those in a normal susceptible strain. "Would satisfactory results be obtained with flies a hundred or more times resistant?" he asked. "Is this a stop-gap measure, or will it really block resistance?"

He said the discovery of Antiresistant won't mean much to the pest control operator until further tests are completed and until a USDA label is obtained for its use.

"I have a lot of faith in the adaptability of the housefly to overcome chemicals," Dr. Shankland said. "I have no doubt we will see houseflies adapt themselves to any attempted control sooner than we will see a successful solution to their ability to develop resistance."

First reports of antiresistant chemicals, made by professor Douglas Hennessey of Fordham University, were published in the November '60 issue of *Pest Control*, pg. 40. One of his methods changes the hydrogen isotope in DDT to make it effective against DDT resistant houseflies, and another technique involves the strategic replacement of one of the four hydrogen atoms in DDT with fluorine, chlorine, or bromine to achieve the same result.

"Rurban" Market

Urban population overflowing into rural areas has brought about a potentially profitable "rurban" market for horticultural and home pest control. Such was the prospect projected by a panel of PCOs and Purdue staffers at one evening session.

While commercial arborists, nurseries, and landscapers may serve larger metropolitan centers, a demand is developing for control of lawn, weed and ornamental pests in smaller communities, Purdue horticulturist Dr. Donald L. Schuder explained. University extension entomologist Dave Matthews said the potential for such service is among professional people who come home to their country "estates" and prefer to relax over a cocktail with hi-fi playing in the background instead of pulling out extraneous plants in their flower beds. Sub- and non-professional workers are more do-it-yourselfers who change into overalls and start pulling weeds after a day at the office.

PCOs Charles E. Knote (Cape Girardeau, Mo.), Robert Troup (Hempstead, N.Y.), and Joseph B. White (Cleveland, O.) all reported they were digging up new business in the home insect control market.

Troup reported his company, Harder Extermination, Inc., is expanding into horticultural pest control at such a rate that in five years this new phase of the firm's operation may well overshadow the volume of business now being realized from structural pest control.

Missourian Knote explained he had to expand from general line p-c work into allied phases because the smallness of Cape Girardeau offered limited demand for routine insect and rodent control. Among his sideline offerings is a tree spraying service. The only drawback to this venture is that its peak season parallels that of his basic structural work and thus creates an added demand for experienced labor. Such problems he willingly accepts since his John Bean spray rig turns out about $125 to $150 tree spraying business daily in the summertime.

White said his Central Service & Exterminating Co. realizes a substantial portion of its income from monthly general pest control contracts in small homes. His service provides control of all structural pests, except wood-boring insects, handled during routine, once-a-month calls plus any no-extra-charge emergency servicing.

"We concentrate on homes in the $25,000-and-up class because such contracts have less turn-over, honor invoices more promptly, and generally provide fewer problems. So far we've found home service is a bit less profitable than industrial work, but it still provides extra income," White reported.

Troup said 60% of his firm's total volume is from the small home group. Included in its horticultural service is the spraying, shaping, pruning, and fertilizing of trees, as well as providing grub and weed control. "This new field can be an extremely lucrative and beneficial service to the public," the New Yorker commented.

Panel moderator Glen Lehker reminded delegates that a whole new set of facts and specialized training is required before anyone should tackle ornamental and horticultural pest control work. One wiser-for-the-experience PCO explained how he had to replace $175 worth of rose bushes because the wrong insecticide his men used killed the "precious" planting.

Panelists agreed there is money among rurban dwellers, but an investment in required training is necessary before seeking to cultivate the green it can bring in.

Bird Control is Guesswork

Two-faced owls, plastic propellers, squawking records, mist nets, and light traps are just a few of the many devices being used by PCOs who are engaged in another relatively new and challenging phase of the industry — bird control.

William D. Fitzwater, assistant district agent for the U.S. Fish & Wildlife Service at Purdue, and

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one of the nation's leading bird control specialists, told an evening gathering that a successful bird control program today is dependent upon a "trial and error" method and that no one control measure is the real answer to reducing undesirable flocks. A combination of two or more techniques is usually necessary for a good job.

Bird control "tools" can be classified into three groups — preventive measures, repellents, and reductional controls.

"Probably the best way to begin eliminating an over-population of starlings, pigeons, and sparrows is by removing their nests," Fitzwater suggested. "Then turn to bird proofing devices and other control techniques."

A fine-threaded Japanese mist net was recommended by the bird expert to screen off roosting and nesting sites on ledges of buildings. Threads of this net are so fine, they cannot be seen from the street.

To repel flocks from granaries, warehouses, and other buildings, ultrasonic sound broadcasters, according to Fitzwater, are good devices.

"These ultrasonic machines emit a high frequency sound up to 25,000 cycles per second which affect the birds' sense of balance," he explained. "In some cases birds don't return for weeks."

Specially designed fireworks were also cited by Fitzwater as good scare devices. A fuse rope, with several "salute bombs" attached at four-foot intervals, can be hung on a tree in a bird infested area. When ignited, the rope smolders upwards, setting the bombs off one at a time at spaced time intervals.

Regular fireworks, such as torpedoes, Roman candles, and salute bombs, can also be used effectively, to chase flocks away Fitzwater said.

The sensitive feelings of a bird loving public must be deftly handled in all bird control efforts. To cope with these situations, Fitzwater suggested use of educational ammunition might help such people understand the problem more clearly.

"Tell them how starlings are a direct cause of the disappearance of bluebirds and quail; how the black pests chase bluebirds from their nests and eat their eggs. Tell them how starlings eat the quail's food and cause them to starve to death," Fitzwater enumerated.

He said it is better to lay all the cards on the table. If birds have

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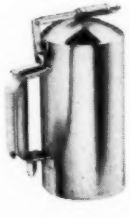

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to be killed let the public know about it. "Before I start a bird control program, I go to the city's newspapers and let them know what I'm going to do," he said. "This is a good way to educate the public."

Rodenticides Not "Jet-Aged"

Development of new and better rodenticides is lagging and more information about the ones now in use is needed. This is what Galen C. Oderkirk, district agent of the USF&WL at Purdue told the Friday morning gathering.

"Considering the jet age of today, I don't think rat control has advanced as it should have," the rodent expert said. "There is still a lot to learn about the acceptability of rat baits."

He cautioned PCOs to keep baits free of contaminating odors and tastes and to store them in a refrigerator, or cooler, to keep them fresh. "Be careful that room temperatures do not get too high if you keep baits in polyethylene bags," he warned. "Chemicals can pass through plastic when the thermometer is high and make baits considerably less effective."

Oderkirk's assistant, Fitzwater, joined the rodent session to project slides illustrating the difference in feces and tracks of mice and rats and how to recognize trails left by the rodents.

Effects of Rabies

Because the incidence of rabid bats has been increasing across the country, an expert on the disease and its vectors was invited to school delegates in this topic.

Symptoms to look for to detect rabies in animals were described by Stephen H. Richards, disease research biologist for the North Dakota Game and Fish Department in Fargo.

He said a rabies victim goes through three distinct stages: a restless, troubled mood; has slight spasmatic tremors; then experiences a fast paralysis of nerves and muscles. Victims usually die within three or four days after symtoms occur.

This is true of all animals except the bat, which can recover from the disease and carry its virus for several months. "Thus the bat is a very dangerous mammal," he warned. "If you find a grounded bat, don't pick it up with bare hands. If you are bitten, send the animal to a testing laboratory immediately, and see your personal physician right away."

The game expert said rabies causes bats to fly upside down, in the middle of day. And, because its sonar is damaged, it constantly flies into objects.

Although their number is relatively small, rodents can also fall victim to the quick-killing disease. "Virus concentrations in rodent saliva are not very great, so there isn't too much fear that rodents will pass the disease on to other animals or humans," he explained.

Threats of disease epidemics, misuse of pesticides, and the potential profits in new service offerings are all dependent upon having a well-trained crew of men who know what precautions to take, and how to meet the public properly.

Arwell's Training Tools

Props that play important roles in the employee training program at Arwell, Inc., Waukegan, Ill., include a flannel board, flip chart, slide projector, movie camera, and a specially designed switch station to operate projectors and lights.

Arwell personnel instructor, John A. Kielp, gave delegates a condensed version of his company's method for training servicemen in rodent control. During a typical Arwell session, sanitation, control measures, rodent characteristics, prebaiting, safety, etc., are covered in 9 to 14 hours, depending on how many questions participating servicemen ask. He said slides and movies which deliver an impact keep trainees alert during the sessions and help them absorb and hold the information being presented.

Arwell's servicemen also receive 8 to 10 weeks field training and one week formal training at the Waukegan office.

A series of charts, called Nomograms, that give short-cut answers to mathematical problems relating to size and volumes of tanks, and formulations, were explained at another session by Lt. Col. Frederick W. Whittemore, Jr., Chief entomologist for the U.S. Army's Brooke Medical Center in Fort Sam Houston, Texas.

Col. Whittemore drafted the charts, which are similar to the Nomographs published in the December '60 issue of *Pest Control*, page 23, to help pest controllers formulate insecticides without endangering their safety and the safety of customers through mathematical errors. He said a properly formulated mixture will also give more uniform results.

The Army colonel voiced the opinion that research for a chemical to which all insects would act alike is futile. He said he is convinced that the speed of resistance is directly related to the extent and intensity of the use of insecticides.

"In Germany, housefly resistance to DDT is virtually non-existant because the chemical is used sparingly as an agricultural chemical and has not had wide-spread use as a household insecticide," he said.

Listen to Communicate

To get your employees to cooperate with you, do a litte more listening. This is the secret of good communications between an employer and his personnel, according to Robert F. Powell, instructor for Purdue's Supervision Institute.

"Take time to listen to what your employee is saying and try to understand why he is saying it," Powell told delegates. "We have a tendency to read our own opinions into the words and actions of other people and to be negative towards their communication before we understand it."

He said listening tends to improve the relationship between a superior and subordinate because both get the feeling that their ideas are being heard.

Importance of practicing the Golden Rule was pinpointed as the key to successful, harmonious employee relations.

And, Competitor Communications

A decrease in customer complaints, an improved willingness of competitors to exchange ideas, and a better team effort are some of the accomplishments of the 18-month pest control extension program conducted by Purdue entomologist William E. Hazeltine.

In an evaluation report of the program, Hazeltine said he contacted about 65% of the 173 operators in Indiana, either by phone or in person, to help them solve pest control problems.

"At first it was apparent that a majority of them were afraid to reveal problems or mistakes they had made for fear their competitors would use such information to some sales advantage," Hazeltine reported. "To a lesser degree this fear still exists."

Many communication barriers between competitors collapsed when operators gathered at state, regional, and county meetings and began to realize that an exchange of ideas is one of the most valuable assets their industry has, Hazeltine commented.

(*Continued on page 62*)

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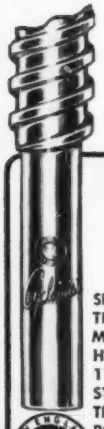

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Operators who braved bitter winter weather to attend Massachusetts U's Eastern PCO Conference

Expect More Mosquito Control Business, Expert Tells Eastern PCO Conference

by
WILLIAM J. FISCHANG
Graduate Student, Department of Entomology and Plant Pathology
University of Massachusetts, Amherst

PCOs can look forward to increased business from large scale mosquito control programs if the prediction comes true that was made by a mosquito control official before delegates to the 21st Annual Eastern PCO Conference held at the University of Massachusetts in Amherst, Jan. 25-27.

This is one of the predictions coming out of the three-day meeting organized to up-date PCOs in the habits and control of mosquitoes, biting flies, roaches, termites, dermestids, thysanura, collembola, and to advise them on business techniques, insurance coverage, and other new developments in the industry.

New England's most bitter winter on record hampered this year's conference organized by Mass. U's entomology and plant pathology chief, Dr. John H. Lilly, and entomology professor, Dr. Frank Shaw with cooperation from the National Pest Control Association. Some 115 braved the snows and sub-zero weather to attend.

"While mosquito control work generally has been done outside the PCOs' field, they will be undertaking more of this work in the future." Such was the forecast of Robert L. Armstrong, superintendent of the East Middlesex Mosquito Control Project in Cambridge, Mass. He gave conferees a run-down of things to look for and what to expect in this type work.

Winter Mosquitoes

Culex pipiens molestus, one of the common house mosquitoes in the Northeast, is known to breed in underground waters, with the result that many warm water sources, such as accumulations in or under cellars, may provide ideal winter breeding sites. He further explained that PCOs may expect particularly severe local outbreaks of *Culex* mosquitoes during dry summer periods, when it is suspected that the mosquitoes may breed freely in small amounts of stagnant water in drains, catch basins, and the like. *Culex* breeding sites, such as rubbish heaps or those described above, may be inexpensively treated with fuel oil or New Jersey Larvicide. Malathion also gives very good results but is more expensive, he pointed out.

Mr. Armstrong's discussion of mosquito control for the PCO was part of a panel discussion on biting flies and their control. Dr. Bernard V. Travis, Cornell University, considered biting flies other than mosquitoes. Panel chairman was Frank K. Harder, Harder Extermination Service, Inc., Hempstead, N.Y.

After describing to the group the habits of major types of mosquitoes encountered in the Northeast, Armstrong stressed two important control considerations: 1. "It is almost mandatory that mosquito control involve large areas," (e.g., whole counties). While mosquito breeding in a small area may be well controlled, migrating adult mosquitoes from other areas may cause severe outbreaks. 2. The use of repeated applications of a low residual chemical, such as malathion, at low dosage rates, is now more widely used than an insecticide with long residue, such as DDT. However, DDT is still useful in winter applications to the ice of swamps, at the rate

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Biting Fly Controls

The 3 major groups of other biting fly pests are considered by Dr. Travis to be 1. black flies or buffalo gnats, 2. punkies or "no-see-ums," and 3. the horse flies and deer flies. Black fly larvae live only in streams, he pointed out, and are, "exceedingly sensitive to insecticides." In New York state, Dr. Travis said, good control is attained by aircraft fogging across streams at ¼ to ½ mile intervals, applying DDT at 0.1 lb. per acre in 100 foot swathes. Any of the common chlorinated hydrocarbon insecticides are very satisfactory for this work, according to Dr. Travis. Two such treatments are necessary, one in early spring to kill overwintering larvae, and a later application to kill larvae hatching from overwintering eggs. Since the adults are strong fliers, he suggests that control be on a community basis, rather than attempting to control flies in a small area.

Other first day panel discussions and panel chairmen were: "Control of Collembola and Thysanura," Kenneth Cook, Ransford Pest Control, Worcester, Mass.; "New Business — Where?" Jacques J. Hess, Exterminating Services Corp., New York City; and "Insecticides for Termite Control," David Feinson, Atlantic Exterminating Corp., New Rochelle, N.Y.

Silverfish and Firebrats

Dr. Harvey L. Sweetman, University of Mass., described, through lantern slides, some easily seen distinguishing features among the firebrat, the 4-lined silverfish, and the common silverfish.

Speaking of their bionomics, Hamilton Laudani, Asst. Chief, Stored Products Insect Branch, USDA, Beltsville, Md., indicated that optimum temperatures for firebrats are between 90°F and 98°F, while silverfish have much lower optima. This important fact was recalled later by R. Weston Kelley, Jr., Northeast Exterminating Co., Rocky Hill, Conn., when he suggested that PCOs look first to the heating plant of a building with a firebrat infestation, because during cool seasons heating plants serve as their congregating places. In warm months, firebrats are well dispersed throughout a building causing unnecessary difficulties for the PCO. Mr. Kelley stated that 10% dust or wettable powders of DDT or chlordane, or sprays of 5% DDT or 2% chlordane have been successful for control of Thysanura. Lindane or sodium fluoride may also be used. Dr. Sweetman suggested that if a building can be vacated for a period of two weeks or more, the use of a vaporizer, with either DDT or lindane crystals, may be an excellent eradication measure. Mr. Laudani recalled that in England, dieldrin and aldrin combined with lacquer has been used in ships to give 3 to 4 years of good control. Mr. Kelley stated that firebrat damage occurs as a result of their feeding on starch sizing, book bindings, labels, and similar materials. In places where food sources are not obvious, Dr. Sweetman suggested the possibility of fungi as suitable nutrients. The panel agreed that firebrats die at temperatures below freezing, and while able to feed at as low as 60°F, they need temperatures in the 90°-98°F range for successful reproduction.

Springtails, Hamilton Laudani informed the group, may be found anywhere if moisture is sufficient.

Mr. Kelley stated that Collembola may also be controlled with the same chemicals used for Thysanura. However if the moisture of the infested area can be reduced, the problem will be solved without the use of insecticides, assured Laudani.

First Impression is Sales Key

The informally conducted panel "New Business — Where?" drew spirited discussion from the interested audience. The correct manner of performing the typical residential pest control call was examined in detail. It was agreed that the first impression made is very important. The PCO should present a simple, high quality business card. It was felt to be essential that the PCO be a good listener; often he will learn a great deal about a problem if he refrains from interruption while the housewife describes her plight.

Choice of Termiticides

Concerning the choice of dieldrin or chlordane for termite control, Dr. Philip Spear, NPCA Technical Director, remarked, "Technically I don't think we have any basis for choosing one over the other!" This view was echoed by Alison J. Kirby, Planters Chemical Corp., Norfolk, Va., another member of the panel on insecticides for termite control. Dr. Spear emphasized that both chemicals have been tested for several years with equal success. However the use of aldrin proved to be another matter, for according to Dr. Spear many PCOs found its odor to be objectionable. Mr. Kirby stated that he has found it to be quite satisfactory in pre-construction treatment, where odor is of little concern.

Discussing termite control in Virginia, Mr. Kirby described the 18-point list of minimum treatment specifications, which has been adopted by the state pest control association. Specifications should be flexible, he said. If one or more of the Virginia specifications cannot be accomplished, this fact accompanied by an explanation is incorporated into the contract.

Several members of the group expressed an interest in the compound "Woodtreat." Mr. Kriby cautioned that, when using this wood-penetrating chemical, PCOs should take care that it is not applied to wood near a floor above, for it is capable of staining floors by penetration from below. Those who had used the material concurred that it possesses good spreading qualities in wood.

Mr. William McAllister, South Jersey Extermination Co., Camden, N.J., has found that when using "Woodtreat" for termite control, he has incidently killed many other wood boring insects.

Dr. Spear suggested considering the use of heptachlor in special cases. Because of its relatively high vapor pressure, heptachlor may be able to penetrate into particularly difficult to reach places.

Another offering from Dr. Spear involved soil treatment around the outside of foundations. He said that evidence exists that parallel holes for liquid treatment drilled obliquely along a foundation give superior coverage to holes drilled vertically. It appears that there is much more vertical movement of liquid in soil than there is lateral movement. Hence, vertical movement of the insecticide from oblique holes tends to fill in the gaps between holes more completely than with vertical drilling.

Dermestid Beetle Damage

Second day of the conference was exclusively devoted to the study of dermestid beetles, common pests for the PCO. A morning laboratory session found conference members busy with hand lenses and microscopes, learning to identify these pests from both preserved and live specimens. Each member took home with him, a personal dermestid collection. Two

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lectures and a panel discussion continued the study through the afternoon.

"Annual damage in the United States attributed to the dermestids has been estimated to run into the millions and possibly billions of dollars," informed expert Hamilton Laudani said in his presentation on the biology of the dermestids. He stated that approximately 9 million dollars in federal and state funds have been spent to eradicate the khapra beetle (*Trogoderma granarium*) from 4 southwestern states.

Control of dermestids was discussed by a most capable panel of Guy V. Dale, Exterminating Services Corp., New York City; Alfred E. Bungay, Buettner Pest Control, Brooklyn, N.Y.; Herman Ratner, Ratner Pest Control, Atlantic City, N.J.; Charles Pomerantz, Bell Exterminating Co., New York City; and Hamilton Laudani.

"Today this pest is a very sizable and profitable end of our business," Chairman Dale concluded about carpet beetles.

"Under no circumstances would I use an oil base spray until I have determined what is under the carpet!" warned Alfred Bungay. A foam rubber pad or a latex backing under a rug may swell if oil is used, causing the carpet to buckle. Furthermore a serious odor problem may result from this combination. "The primary source of infestation will usually be around the perimeter of the room or under a piece of furniture which is seldom moved," he explained. While Mr. Bungay felt that cotton or synthetic carpets need not be treated, Mr. Pomerantz later cautioned that work in California showed carpet beetles under stress to feed on synthetic fibers. Inspections should include kitchen cabinets under loose linoleum and basement storage sites, Mr. Bungay claimed.

"We have always used a combination spray of ¼% lindane with 3% DDT," offered Herman Ratner. His company prepares its own formulations by adding the correct amount of technical grade insecticide crystals to the desired solvent and mixing with a Red Devil Paint Mixer. He further suggested the possible use of a silica aerogel compound-viz., Dri-Die insecticide 67, in attics, voids, etc. Mr. Ratner advised that satin or silk-type furniture cannot be sprayed without danger, but, "Perhaps a small amount of DDVP injected by needle would be helpful." He warned that some formulations of emulsifiable chlordane leave a tacky residue which can cause trouble on rugs.

"Lindane is one of the best insecticides we ever had against carpet beetles," said Hamilton Laudani, yet he cautioned PCOs that the law allows spraying of lindane, dieldrin, or chlordane only around the perimeter of a room and not over the entire floor surface.

Describing a fascinating situation in which the khapra beetle had been accidentally introduced into New York on burlap-wrapped steel from Italy, Mr. I. B. Carncross, Syracuse Chemical Co., Syracuse, N.Y., explained the fumigation techniques which his company employed in treating the infested steel.

Roach Resistance

On the final day of the conference, Dr. James McD. Grayson, Virginia Polytechnic Institute, Blacksburg, clearly described investigations of roaches at VPI as explained in his article which appears in the January '61 issue of *Pest Control*, pg. 30.

Comparing roaches resistant to several insecticides with non-resistant roaches, workers at VPI made several biological and morphologi-

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cal studies. They found resistant roaches produce fewer nymphs, smaller egg cases, and smaller, lighter adults. Dr. Grayson concludes that resistant roaches are not a superior strain if in the normal environment, but only are superior in the presence of the insecticide. "Except for this specialized chemical environment, they are inferior roaches," he stated.

Suggests Broader Insurance

Robert L. Showalter, NPCA Executive Assistant, spoke on some of the problems of insurance needs of the PCO. Confining his address to public liability insurance, he noted the alarming increase of about 80% in rates of property damage premiums, in the last year. Mr. Showalter strongly recommended that PCOs purchase a comprehensive policy, which gives much broader coverage than a general liability policy. He warned of three major problems: 1. Policies should cover the PCO for property damaged while in their, "care, custody, or control," 2. PCOs should be insured for "completed operations" — i.e., any damage occurring after the actual service, and 3. Due to complicated differences in meanings of the two words, the word "accident" in a policy should be changed to "occurrence," for protection.

Hercules 7522C Promising

Dr. Philip J. Spear enlightened the group with important new developments in pest control. Commenting on Hercules 7522C, he said, "This is our best present hope as a successor to the organic phosphates for control of cockroaches, if this becomes necessary."

In reply to a question about roach resistance, he informed the group that, "Chlordane and dieldrin resistance is primarily a problem of this country and ports of ships which call here." A promising long residual organic phosphate insecticide, mentioned by Dr. Spear, is Bayer 29493. This chemical will be produced by Chemagro Corp. in the United States. It has been made available to the NPCA insecticide committee for field testing, and results are expected within the next 2-3 months.

Trithion may be used successfully for yard work to control chinch bugs or clover mites, and perhaps earwigs, he noted. Where roach resistance is not a problem or for the control of ants, the NPCA official remarked, two formulations of lacquer, containing dieldrin, have been registered. These materials may be used for long time control. Regarding the possible use of sevin in roach control, Dr. Spear cautioned, "I want to warn you that sevin will stain."

Another potentially important development which was considered by Dr. Spear involved rat control. A report in Europe of the failure of warfarin to satisfactorily control Norway rats, prompted an experiment in which field collected rats were compared with a control group. The results of a 5 day test with warfarin resulted in only 1 death of the 9 field rats used, while 12 of the 15 control rats died. Dr. Spear cautioned that this single experiment hardly proves rat resistance to warfarin has developed, yet he encouraged PCOs to be alert to this possibility.

Closing session of the conference saw Dr. John H. Lilly, Head of the Department of Entomology and Plant Pathology at the University of Mass., exploring the minds of the audience for new ideas for the 22nd conference. According to Dr. Frank Shaw, also of the department, co-chairman of the Eastern Conference, the meeting in 1962 will be held on January 24-26.

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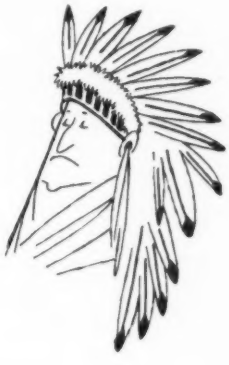

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Chemical Make-up of Soils, Poisons Affect Control, Dr. Osmun Tells TOs

Purdue Conference Report
(*from page 54*)

Termiticides vary greatly in their behavior in soils, not only because of their molecular make-up, but also as a result of the different kinds of soil found around a structure. Such variables decide the degree of acceptability the soil will have for a chemical and the kind of termite protection an application will afford.

This is what Purdue's chief entomologist, Dr. John V. Osmun, told members at this year's PCO conference during a morning termite session. It was programmed to clarify some of the obscurity associated with questions about what happens to soil poisons once they are soaked into the ground.

Soil types, be they sand, loam, or clay, as well as the amount of moisture they are holding, and the degree of their organic content, influence not only the effective residual life of chemicals in soils, but also how much of the toxicant a termite will contact. Dr. Osmun explained a termite can pick up more of an insecticide when it is applied to sand than when the toxicant is in soil high in organic content.

"A chemical's adherence to soil varies with ground moisture," he said. "In a damp soil, water and chemical compete with each other to bind onto soil particles." He suggests that in very dry soils, or in highly organic soils, the amount of toxicant should be increased.

Tests conducted in the Purdue termite laboratory by Dr. Osmun and graduate entomologist Jack Bready, shed some light on the movement of various termite control materials in dry and wet soils.

Dr. Osmun said chlordane, heptachlor, dieldrin, and aldrin in moist soil moved about 8″ in five months. DDT movement was not detected, and although lindane did move, it did not redeposit appreciably on the soil.

"In dry soil, movement was only 2″ by all the chemicals except DDT, dieldrin, and aldrin, which did not move," the department head reported.

It's what we don't know about termites that concerns these two experts on the subject, Virgil K. Smith of the Forest Service (left) and Ira Hatfield, Wood Treating Chemicals.

In addition to the variable characteristics of soil, physical properties of the chemicals themselves influence their effectiveness and residual life under ground. Their vapor pressure, their ability to bond with soil particles, their ability to convert to other compounds, and their inherent toxicity affect the killing power of soil chemicals. DDT bonds so tightly to the soil that the insecticide might not be available to kill termites, whereas heptachlor, and the other cyclodienes are not so attracted to soil particles.

Cyclodiene compounds can be converted to either less toxic materials or to ones that are more stable, depending upon the changes in their chemical structure that takes place in the ground, Dr. Osmun said.

"For example, aldrin changes to dieldrin and becomes more stable when one of its atoms is modified by adding an oxygen molecule. When heptachlor is altered by the addition of an oxygen atom, the resultant material is a more stable chemical that is presently known as heptachlor-epoxide. This insecticide may some day be marketed under a trade name," he advised the group.

The process of modifying one molecule with the addition of an oxygen atom is called expoxidation.

"Tests being run by Lichtenstein at the University of Wisconsin in Madison indicate that when 25 lbs. of aldrin are applied to one acre of ground, within a year 39% of the chemical has changed to dieldrin. When the same quantity of heptachlor is applied to a similar plot of land, 16% of it goes over to heptachlor-epoxide in 12 months," Dr. Osmun reported. "There are indications that such conversions might be less if the dosage per acre is increased. The degree to which these findings can be applied to conditions found under a house has not yet been demonstrated."

Another physical property which affects the residual life of soil chemicals is their vapor pressure, the ability of an insecticide to pass into a vapor stage. "This is common with lindane and can be an advantage or disadvantage, depending upon how the chemical is applied and the temperature of the soil. In warm soil a high-vapor chemical would vaporize quickly and find its way through the soil until it hits a rock, or other obstructions," he said.

Dr. Osmun urged termitemen to keep high the toxicant levels of soil poisons because laboratory and field tests have shown there is a sharp breaking point in the degree and length of kill when chemicals are used below recommended dosage rates. The variety of conditions one finds in soil might mean, if reduced concentrations are applied, that you could have 100% kill one year and no control at all the next, he warned.

"I hope the time will come when we'll recommend how much actual chemical by weight is to be put into the soil, instead of basing recommendations upon the volume of total formulation," Osmun concluded.

Treated Lumber No Barrier

The ability of termites to tunnel over lumber treated with a variety of chemicals is being proved at Georgia University under the direction of Dr. Horace O. Lund,

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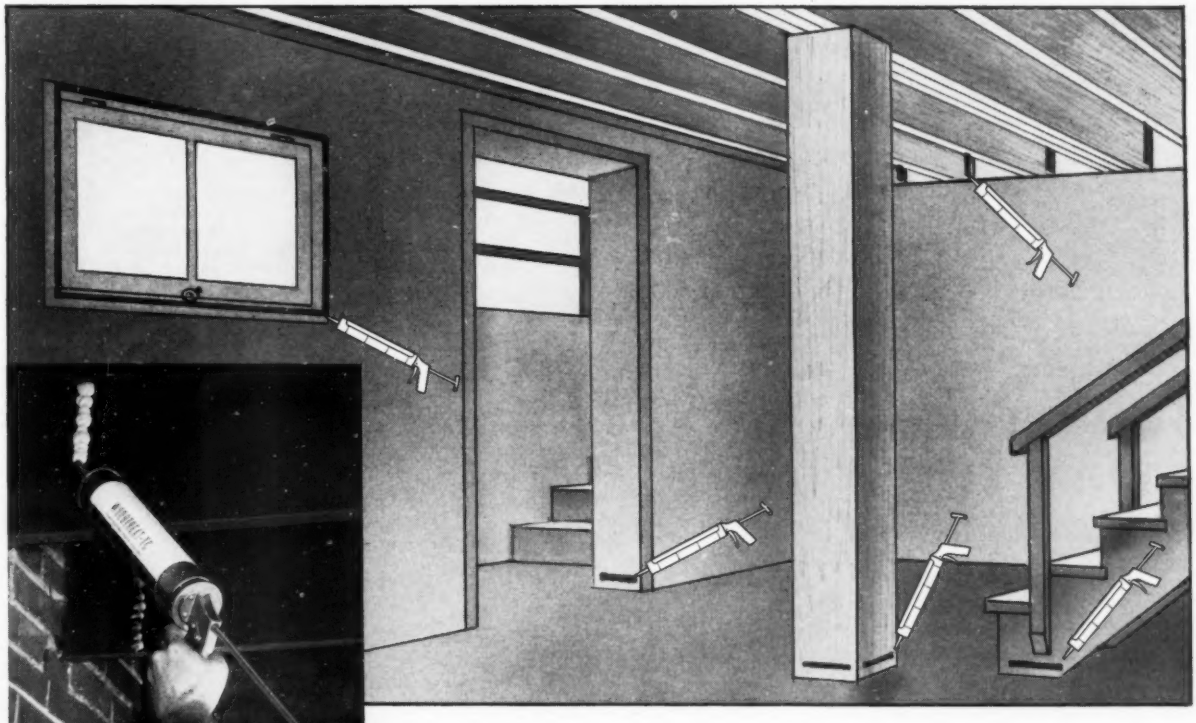

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the school's chief entomologist.

On wood treated with Osmose, termites built tunnels to the top in 9 days. Over a heavily creosote treated pedestal, tunnels were erected in 19 days. Wood protected with copper naphthenate was spanned in 27 days; with Wohlman salts, 28 days; with copperized chromated zinc chloride, 16 months, and with pentachlorophenol, 24 months.

He said tests now include wood treated with copperized Boliden salts and with cellcure. "From what we've learned so far, I don't think any of these rot protecting chemicals will insure against termite tunneling."

Asked whether any tests have been run using wood painted with termite soil toxicants, Dr. Lund replied there weren't, but that "this is one experiment I hope to get under way soon."

During that part of the program devoted to termite control, Myron W. Smith of Hill-Smith Systems, Memphis, Tenn. told delegates about permanent termite proofing installations. "Not one of them comes anywhere close to a cure-all for termite control," Smith reported.

Virgil K. Smith, Jr., researcher from the U.S. Department of Agriculture's Forest Service Laboratory in Gulfport, Miss., spoke for about 20 minutes just listing unanswered questions relating to termite control.

For example, Smith reported that termites thrive in Mississippi muck, yet in another areas of the state, they are found in soil so dry that they build their tunnels of pure limestone. "How is this possible?" he asked.

Smith is taking a leave of absence from the Forest Service to work at Purdue to find some of the answers to problems in the increasingly complex field of termite control.

Seven Ways to Lose

What he called the seven deadly sins against pest control safety were spelled out by William Butts in a closing session of the week-long program.

He said operators should be sure they and their servicemen should not 1. use improper containers for pesticides, 2. neglect to use protective equipment, 3. use improper mixing implements, 4. handle rodent baits loosely on the job, 5. neglect to wash their hands, 6. disregard the possibility of accidents, and 7. neglect to make colleagues and clients fully aware of hazards involved in a pest control operation.

Mutual congratulations for 25 successful conferences were exchanged by the two men responsible for them: emeritus entomology department head, J. J. Davis (left) who originated the university-PCO short course idea, and Dr. John V. Osmun, present-day chief of Purdue's expanded entomology program.

At the special anniversary banquet commemorating this conference's silver anniversary, three PCOs were each given Purdue emblemed silver cuff links and a tie clasp for having attended the conference all of its 25 years. They were W. W. Scott of Arwell, Inc., Waukegan, Ill.; C. Norman Dold, Rose Exterminator Co., Chicago, Ill.; and Harlem B. Ives, Rose Exterminator Co., Detroit, Mich.

Delegates honored department head, Dr. John V. Osmun by presenting him with a special typewriter and portable copying machine needed by members of his staff. Conference founder, emeritus professor of entomology, John J. Davis, was awarded silver, diamond studded shirt jewelry etched with Purdue's official seal.

Chosen to be "pest of the year" for the 26th annual conference is wood infesting insects including termites. The 1962 meeting will be held January 22-26.

Study Vertebrates, Tools, Termites at NC PCO School

Vertebrate and termite control, and PCO equipment were the three topics that filled the curriculum of the 11th Annual Pest Control Operators' School at North Carolina State College, Jan. 17-19 in Raleigh.

During the first day's session biology, identification, and control of birds, rodents, skunks, snakes, and lizzards were explained by university officials, F.E. Hester, F.S. Barkalow, and H.M.

Fields, and U.S. Fish & Wildlife expert J.B. Lindley of Raleigh to some 100 PCOs who registered for the course.

Operators were divided into groups and rotated classrooms where they observed actual specimens and materials used to control vertebrate pests.

Discussions and demonstrations of control equipment were featured during the second day with industry representatives participating in the program. Air hammers, drills, power sprayers and fog machines were featured. Stressing safety use of power and electric equipment was N.C. State entomologist, R.T. Gast.

A report of termite tests at the U.S. Forest Service Southern Experiment Station in Gulfport, Miss., by Joseph Kowal, launched the termite program on closing day of the school. Others who participated in this session were Frank Lyons, of the E. L. Bruce Co., Memphis, Tenn., and Robert L. Showalter, executive assistant of the National Pest Control Association.

This year's course was directed by the university's head entomologist, Clyde F. Smith.

Members of the North Carolina Pest Control Association held their annual meeting during the affair and elected A.T. Best, Best Exterminating Co. Durham, president; W.C. McCellan, Guaranty Exterminating Co., Raleigh, vice-president, and Robert Hutchcraft, Terminix Co., Charlotte, treasurer. Chosen as directors are Marvin Scull, Allied Exterminators, Durham, W.O. Deason, Deason Termite & Pest Control, Hickory, C.E. Pearsall, Carolina Exterminators, Fayetteville, and Phillip Melotto, Antex Exterminating Co., Fayetteville.

Asheville was chosen as the site for the annual Tri-State meeting to be held during the first week in August.

Vapor Barrier Stops Termites

A vapor barrier that is said to kill termites as it keeps out moisture has been introduced to termitemen recently by its developers, Bird & Son, Inc., East Walpole, Massachusetts.

Called Termibar, the barrier is made up of two layers of polyethylene sheeting, wet-strength kraft paper, and a heavy felt, impregnated with deildrin and a fungicide.

According to the company, Termibar is designed primarily for new construction as a pretreat measure. It is rolled onto the gravel fill of a structure before the concrete slab is poured. It comes in rolls 6 ft. wide and 92 ft. long and must be laid with a 6-inch overlap.

Supplementary measures available for use with Termibar are Bird & Son's Termibar Caulk for protection around pipes, structural members, and other openings, and Termibar Liquid, an emulsifiable concentrate containing 4 lbs. of aldrin per gallon, for treatment of the fill around the exterior of buildings in which Termibar is used.

Termibar, installations approved by Bird authorized dealers, may be accompanied by a five-year guarantee as required by the Federal Housing Commission.

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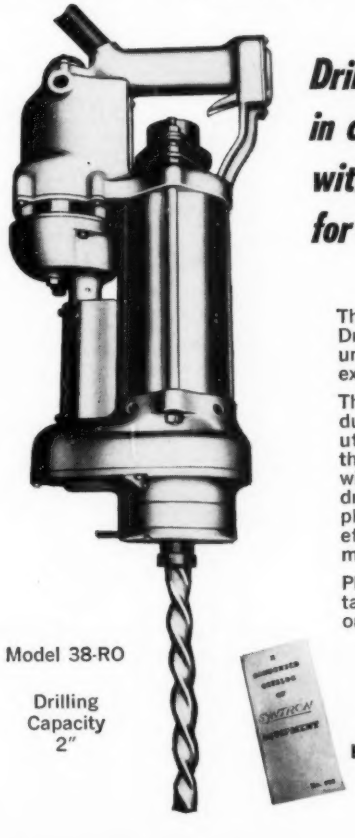

Model 38-RO

Drilling Capacity 2"

Drill fast, clean holes in concrete or masonry with the 38-RO, designed for Pest Control men

The Syntron 38-RO Electric Hammer Drill is a heavy duty, 2" capacity unit, that is becoming the choice of exterminators everywhere.

The electromagnetic drive unit produces 3600 powerful blows per minute — drills clean holes quickly through concrete, stone, or masonry without manual quarter turning of drill bit—rotation is automatic. Simplicity of design assures life-long efficiency, dependability, and low maintenance.

Phone the nearest Syntron Representative for a free demonstration without obligation or . . . .

Write for a Syntron Catalog section on Electric Hammers & Hammer Drills.

61EH6

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SYNTRON COMPANY

790 Lexington Avenue • Homer City, Pa.

What's NEWS In The Industry

PCOs Meet at MSU March 16, 17

What the potential is for new pest invasions via the St. Lawrence Seaway will be analyzed by C.A. Boyer, director of the Division of Plant Industry, Michigan Department of Agriculture, at the Michigan State University PCO Conference to be held March 16 and 17 in East Lansing.

Arranged by MSU and program chairman, Frederick Kuhn, Grand Rapids, the program will also feature Dr. Max Wilcom, Communicable Disease Center, Atlanta, Ga., and Leroy Stone, Lansing vector control specialist, in a review of vector control measures.

Other speakers and their topics are: William D. Fitzwater, assistant district agent for the U.S. Fish & Wildlife Service, Lafayette, Ind., "Rodent Control;" Dr. Ray Hutson, MSU's chief entomologist, "Material Drift and Residues;" Dr. R.L. Janes, MSU extension entomologist, "Cluster Flies;" Lloyd Stitt, of Velsicol Corp., "Ecology and Roach Control;" Dr. Ralph E. Heal, NPCA executive secretary will talk on public relations and termite service; W.A. Thompson, Kellogg Co., entomologist, "Mill Sanitation;" and Dean Lovitt, assistant chief of Michigan's Plant Industry Division, who will review the state's one year old sprayer law.

A tour of the Michigan Agriculture Dept.'s laboratory will conclude the meeting.

Pesticide Stockpile Steady

Carryover stocks of pesticides last year were changed little over 1959 leftovers, according to an announcement from the U.S. Department of Agriculture.

Results of an annual USDA survey in cooperation with the National Agricultural Chemicals Association, revealed inventories of insecticides held by basic chemical manufacturers and mixing plants were only 2.8% above 1959, fungicides were down 7%, and weed killers up 14.5%.

DDT and its mixtures remained on the same level as in 1959, while stocks of organic phosphates were up 13.6%.

Some of the 125 operators who attended Arizona U's serviceman-accented PCO Conference.

Basic Insect Control for Servicemen Highlights Arizona U. PCO Conference

Classroom and laboratory sessions designed primarily to teach servicemen how to recognize insects and their damage made up the core of the Second Annual University of Arizona Pest Control Conference held Jan. 20 and 21 in Tucson.

Such pests as termites and caterpillars were scrutinized by some 125 operators at the affair sponsored jointly by Arizona U. and the Structural Pest Control Association of Arizona and arranged by conference chairman, Matthew Van Stelle of Matthew's Pest Control Service, Tucson.

Launching the termites session was Purdue University's chief entomologist, Dr. John V. Osmun who described the biology and habits of the wood-eating insects and how they react to various chemicals and enviornmental conditions. Dr. Osmun, at a banquet session, also gave a report on his recent trip to Russia and described people, places, and pests, behind the iron curtain.

During an afternoon session labeled "a review of the fundamentals of insect control for servicemen," Dr. Laurence A. Carruth, Arizona U's head entomologist, and a member of his staff, Dr. James M. Witt, reviewed principles of control, and natures and hazards of common insecticides. Explaining the principles of termite control was Norman R. Ehmann, Neil A. Maclean Co., Los Angeles.

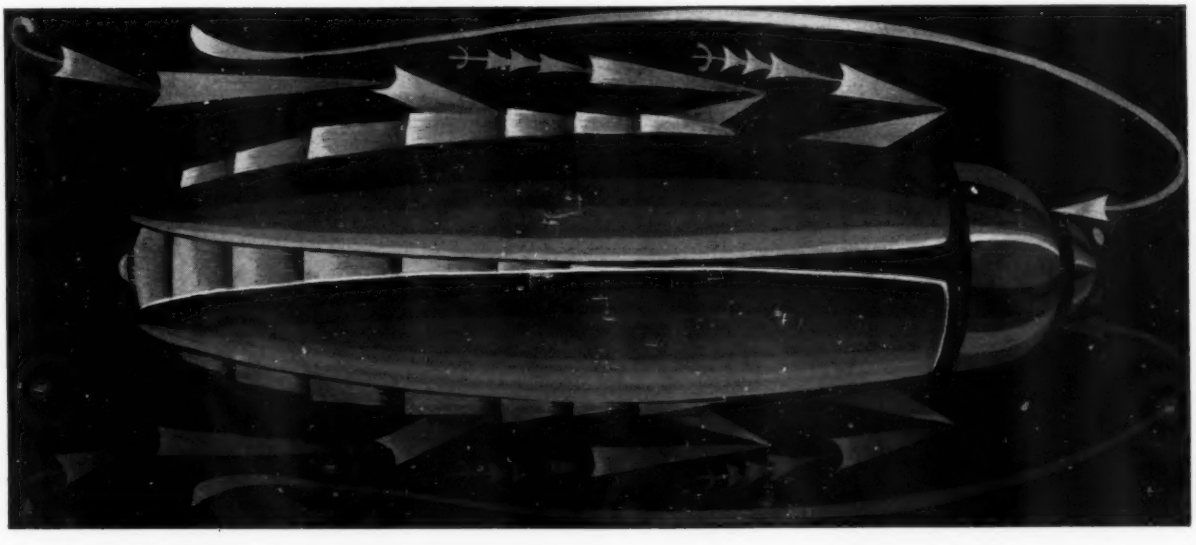
While their servicemen were being up-dated, managers and owner-operators met at a business session to discuss the high costs of duplicate advertising in the termite and general pest control sections of

(*Continued on page 68*)

Cincinnati PCOs Form Assn.

Pest control operators of Greater Cincinnati, Ohio met recently to form the Greater Cincinnati Pest Control Association. The 35 initial members chose as their officers Robert D. Friedman, Terminix Co., president; Arch Brown, AVC Exterminators, vice-president; Richard Myers, American Exterminators, secretary-treasurer, and as directors Carlson Engle, Home Exterminators; B. R. Scherzinger, Scherzinger Corp.; and Neil Miller, Orkin Co.

KORLAN 24E KILLS RESISTANT STRAINS!



Korlan® 24E insecticide knocks out resistant strains . . . non-resistant strains, too . . . of roaches, flies and bedbugs—most kinds, in fact. And Korlan 24E kills where it's been sprayed for as long as six weeks!

Less toxic than any organic phosphate with equal residual action, Korlan 24E is safe for use in kitchens, and food and meat plants. There's no staining of walls or lingering odor, either, to tell you've been there. Only the absence of live insects tells that!

Long-lasting control. The extended residual action of Korlan 24E reduces your number of return calls . . . helps keep customers satisfied while you're busy elsewhere.

Korlan 24E insecticide is stable. Pre-mix it in oil and store for future use. It's completely soluble in deodorized kerosene and common base oils, and emulsifiable in water.

PRODUCT ADVERTISED HEREIN COMPLIES WITH U. S. LAW

When used as directed on label and in accordance with good practices, complies with the Food and Drug Law and other Federal Laws.

THE DOW CHEMICAL COMPANY DOW Midland, Michigan

Granular Herbicide Research Inadequate, Weed Conference Told

Granular formulations for weed control and methods by which to apply them are gaps in weed control that need to be filled. This appeared evident at the Northeastern Weed Control Conference held at New York City's Hotel New Yorker, early this year, as most of the 700 conferees craved for more knowledge of granular applications.

Only in the last year or two has there been an appreciable study of dry granular carriers for herbicides, so research to date is wholly inadequate to permit many conclusions or generalizations of their effectiveness. This is what R.D. Sweet, of Cornell University's Department of Vegetable Crops, told weed workers. He said the high interest in granulars stems from a dislike for hauling water or transporting sprayers when conventional sprays and wettable powder formulations are used.

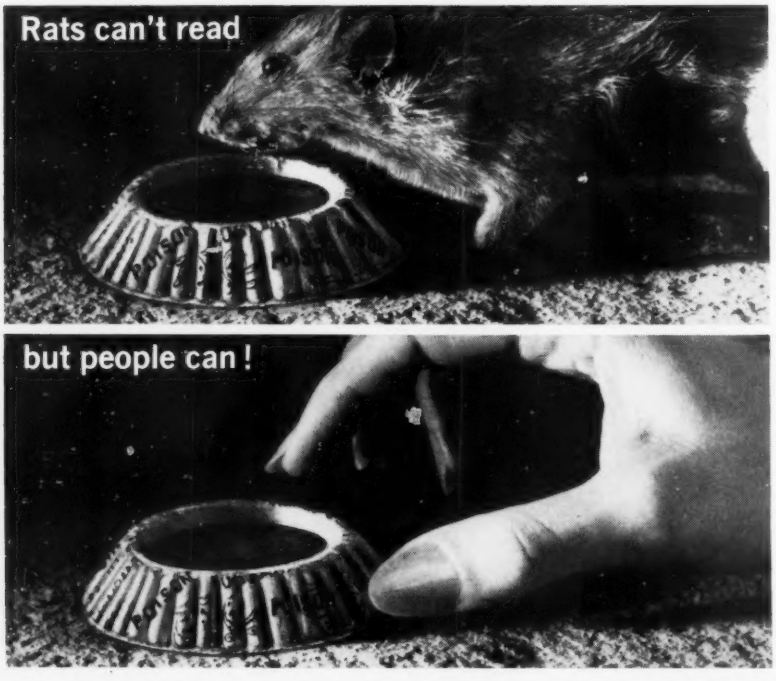
To get good results with granular formulations, Sweet said the chemical itself must be compatable with the granules. For example, he said, EPTC almost always gives better results on a granule than in other formulations, while Atrazine performs better as a wettable powder. CDEC may perform better or worse on a granule depending on factors now unknown.

He said the influence of environment and soil on granular formulations must also be understood before good control can be obtained.

As for granular spreading equipment, the Cornell expert said presently it does not lend itself to easy, accurate application, however, equipment manufacturers are aware of the needs, and presumably in the near future will have machines available for the job.

Weed combaters also were given a preview of several new herbicides developed by Eli Lilly Co., Amchem Products, Velsicol Chemical Corp., Rohm & Hass Co., and Niagara Chemical Division of Food Machinery and Chemical Corp.

A copy of the conference proceedings, which includes detailed information of these new weed killers, can be obtained for $4.50 from D.A. Schallock, Extension Weed Control Spec., Rutgers University, New Brunswick, N.J.



ECONOMICAL RAT JIGGER* CAN'T TIP, CAN'T LEAK, SAYS 'POISON' ALL OVER IT!

Spill-proof! Exclusive flared skirt construction prevents container from tipping, even if rat or mouse steps on rim! Holds 3/5 ounce.

Leak-proof! Tests show: no seepage after 18 days, thanks to strong seamless, one-piece construction.

Absolutely safe! Unmistakable skull and crossbones warning signals, word POISON printed in large capital letters, all over!

Easy to handle! Saves you time, and it's economical, too. Prices only $5.62/1000 for lots 5000 to 25000.

Tested and approved! Rat Jigger* Rodenticide Container meets all the rigid specifications of Federal Agencies and the N.P.C.A. Sets standard for quality and safety as incorporated in Standard Safe Handling Procedure for Compound 1080 (Sodium Fluoroacetate) and other liquid poisons. Packed 5000/case.

*T. M. Pat. Pend.

Prices through your distributor

1-5M	@ 6.75M plus PP
5M-15M	@ 5.62M plus freight
20M or over	@ 5.62M freight prepaid

Universal Paper Products Company, 380 Lexington Avenue, New York 17, New York

DISTRIBUTORS OF 1080 RODENTICIDE CONTAINERS

1. B & G Company, Plumsteadville, Pa.
2. B & G Company, 2640 Myrtle Springs Road, Dallas 20, Texas
3. Clark Products, Inc., 825 W. Evergreen Ave., Chicago, Illinois
4. Pest Control Equipment Co., 24 North Bond Street, Mt. Vernon, New York
5. Pyrrole Chemical Corp., 817 Spring Lane, Portsmouth, Ohio
6. Hub States Chemical & Equipment Co., 1225 North Windsor St., Indianapolis 1, Indiana

Arizona Conference Spotlight Shines on Basic Insect Control

(*from page 66*)

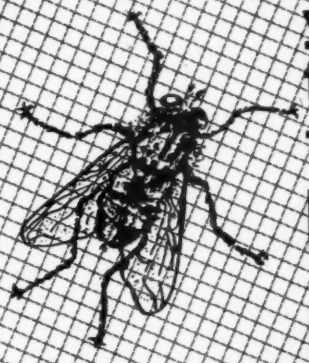
yellow page phone directories. A committee was appointed to gather statements from Arizona operators expressing their desire to advertise under one heading in the telephone book. These requests will then be presented to the phone company for its consideration.

A new slate of officers was also elected by the business group to head up the association for 1961. Elected were Hector Manciet, Tucson, president; Truley Nolen, Tucson, vice-president; John Dwyer, Phoenix, secretary; Fred Daily, Tucson, treasurer; and Matthew Van Stelle, Tucson, director.

Now in Pellet Form

A warfarin-blend rodenticide in pellet form is now being sold by the d-Con Company, Inc., manufacturers of d-Con Ready Mix, according to Frank A. Corbet, the company's president.

XUM



you can be
first in your area
to sell the only 24 hour . . .

UNATTENDED FLY CONTROL

NEW!

BOOST INSECTICIDE SALES AND PROFITS WITH . . .

SYNCRO-MIST & KONK

Automatic Metered Dispenser

Pyrethrins-Piperonyl Butoxide Fly Killer

Here's the **AMAZING BUT PROVEN TRUE** story of **SYNCRO-MIST & KONK** in action

*Dispenses 6.6 milligrams of Pyrethrins and Piperonyl Butoxide per hour per 1000 cubic feet . . . equal to 1/4300 of 1 ounce, yet guaranteed to destroy all flies in area!

*User's cost is only 8/100 of 1c per hour per 1000 cubic feet . . . a terrific selling point, and it still makes big, big profits for you!

This is why **SYNCRO-MIST & KONK** are the #1 Fly Control team:

- Scientifically developed and proven . . . thousands of units already in use
- Automatic metered action dispenses measured doses of insecticide 24 hours a day . . . unattended!
- Kills flies, mosquitoes, gnats . . . including "resistant" insects!
- Plugs into standard 110V AC electric outlet . . . one 12-oz. bomb of KONK lasts approximately 34 days!
- No evaporation or leakage . . . waste is eliminated!
- SYNCRO-MIST unit installed in seconds . . . handsome, unobtrusive!

GUARANTEED TO KILL FLIES AND PREVENT FLY POPULATION BUILD-UP

for complete descriptive literature, write to:

SYNCRO-MIST CONTROLS, INC. 270 MADISON AVENUE NEW YORK 16, N. Y.

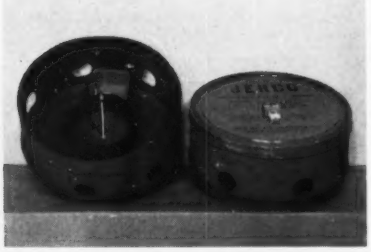
Insects' Blood Cells Affect Resistance, Cornell Prof. Says

Find a way to combine blood cell-destroying chemicals with phosphate insecticides and you can beat insect resistance. This is a prediction of Professor Robert L. Patton of the New York State College of Agriculture at Cornell U., Ithaca who has devoted some 15 years studying the relationship of insects' blood cells to resistance.

He announced recently that tests conducted at Cornell confirm his theory that a greater number of blood cells produce a stronger resistance to phosphate insecticides.

Prof. Patton's first clue to the significance of blood cells came in 1946 when a Chinese student at Cornell discovered that as the specific gravity of an insect's blood increases, the creature's susceptibility to phosphate insecticides also rises. In subsequent tests, Patton learned that when foreign materials enter an insect's blood stream, individual blood cells engulf the unwanted material as a protective measure.

With the help of his graduate students, Prof. Patton also learned that certain materials, including ethyl alcohol and finely ground glass, cause blood cells to break down during this engulfing process. They found that when large numbers of cells were destroyed, the enzymes that help insects resist phosphates were also destroyed, leaving the insects vulnerable to chemical attacks. Prof. Patton admitted, however, that much research is still needed before such a product can be developed for market.



Jerco rodent bait stations hold 2½ lbs. of bait and 1½ pints of water and are made of heavy steel with a safety lock to keep out children and pets. Designed to withstand rugged outside weather conditions, their large size (19″ in diameter and 8″ high) enables many rats to feed at one time. For full details write J. E. Ronicker Company Laboratories, West Milton, Ohio.

Promotion with a service was the aim of Truly Nolen Exterminating Co., Phoenix, Ariz., when it provided free "buggie" rides for foot-weary visitors to the Arizona State Fair. Motorists welcomed the step-saving idea as they were met by the tractor-trailer rig at the parking lot and driven to the Fair's main gate. Standing alongside the "buggie" trailer are Red Veasy, (left) manager of Nolen's Phoenix branch, and owner Truly Nolen.

Commission Hit by Fla. Auditor

Florida's Structural Pest Control Commission was reportedly criticized recently by State Auditor Bryan Willis who said the agency failed to keep permanent financial account records for a five year period ending June 30, 1959.

"Books the commission began keeping after 1959 were not balanced," Willis said. An audit of the commission's account records was said to have indicated the group did not stay within its budget for regular expenses, failed to keep formal property records, and did not always submit expense vouchers.

Willis said the money taken in by the agency apparently ranged from $4,235 to $15,301 per year, and that the commission overspent its income for most of the six fiscal years covered by the audit. In 1959, however, the balance climbed to $2,524 into the black, he added.

Calif. PR Program Hits Snag

A $60,000 public relations program for the Pest Control Operators of California, Inc., drawn up by a west coast advertising firm and to be financed by operators through a sliding scale fee schedule, met with opposition at a recent board of association directors' meeting in Los Angeles.

California operators initially trumpeted an all-out, state-wide public relations push as a "can't miss" venture when first steps to promote the industry were taken in September, 1959. But at the directors' meeting the trumpeting was muted by disagreements over the newly submitted program.

One operator suggested the program be abolished inasmuch as the association does not even financially support its executive secretary. "It is foolish to attempt a $60,000 program," he said. "Public relations should be administered by the executive secretary and dues increased to meet the costs."

Another suggested that individual districts conduct their own PR programs. After considerable pro and con discussion, the association agreed to present the proposed program with its sliding scale financing to operators in each district for their ratification.

Diamond-edged Dymobits for drilling holes or cores from 3/16 of an inch to 6¼ inches, are new products of Milwaukee Electric Tool Corp. The tubular-looking drills contain diamonds embedded in a tungsten carbide crown, patterned so that each takes its share of the cutting load, company officials explain. For more complete data on Dymobits, write for Bulletin DD2 from the company, at 5300 West State St., Milwaukee, Wis.

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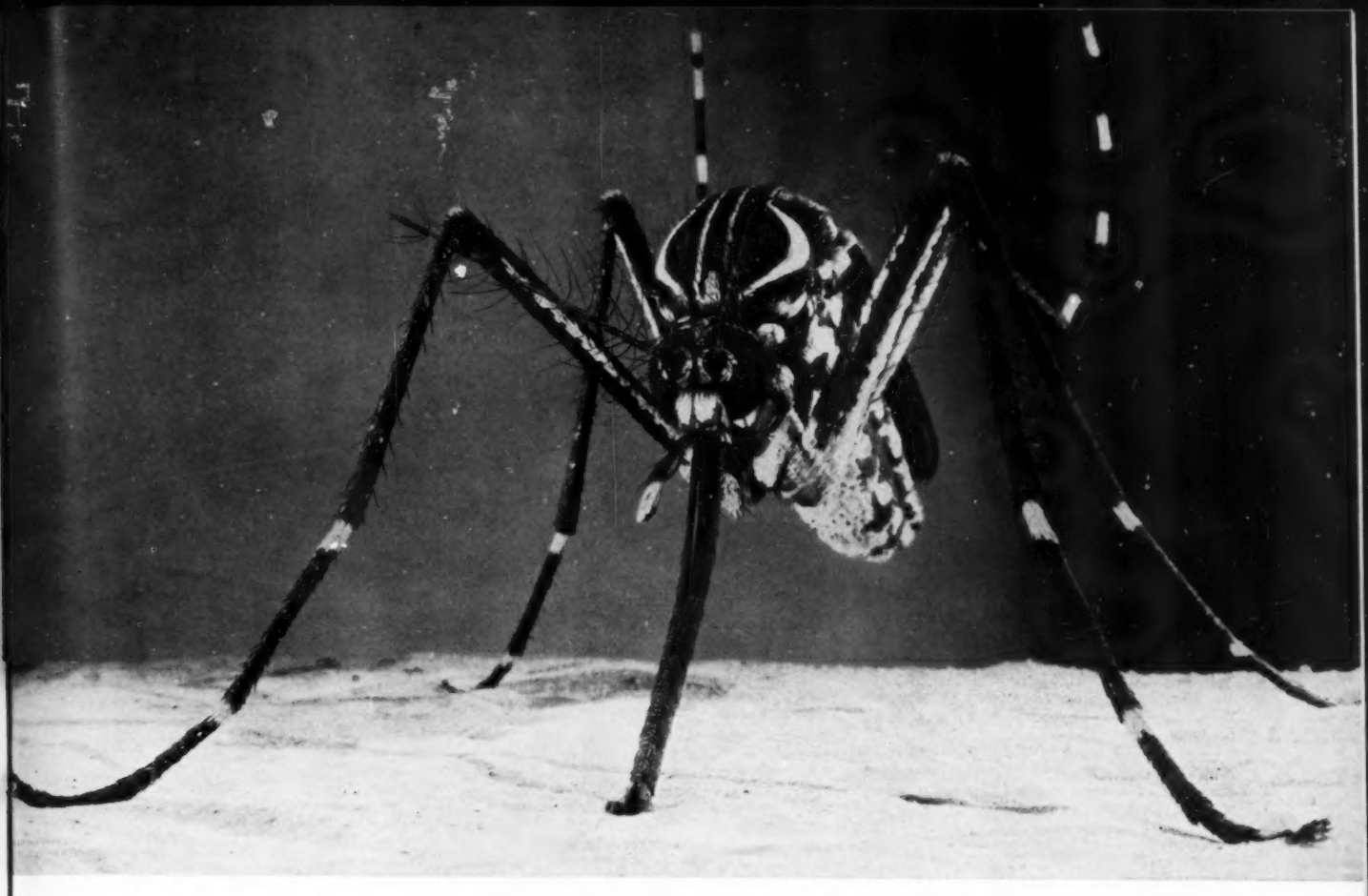


NOW SHE'S REALLY HAD IT!

Economical malathion-Lethane combination gives 30% better kills than presently-used insecticides ... controls resistant strains, too

60% kill of mosquitoes in area control work is no longer good enough. 90% *plus* is what you can expect with a malathion-Lethane combination. The cost? Comparable to presently-used but *far less effective insecticides.*

Controls larvae and adults

Malathion plus Lethane gives spectacular results on both life stages. While recommended rates are generally higher, 1/10 lb. per acre has given excellent control of adult mosquitoes in Florida. Hundreds of thousands of acres are being treated yearly for larvae in California at 1/2 lb. per acre with similar results.

Controls resistant strains

While malathion is replacing less effective insecticides in all areas, it is particularly useful in the many areas where mosquitoes have become resistant to chlorinated insecticides. Here, authorities have switched almost exclusively to malathion because it is *the* phosphate with low toxicity to warm-blooded animals. The U.S. Public Health Service reports that malathion is actually less toxic than DDT. Vector control authorities, park and city managements are specifying malathion for its combination of mosquito-killing power and safety in use. It can be applied by air, thermal fogging and mist spraying with equally good results.

Formulations widely available

Malathion formulations are supplied to area control authorities by many well-known manufacturers under their own brand names. *Write to American Cyanamid Company,* maker of technical malathion, for detailed information on area mosquito control. American Cyanamid Company, Agricultural Division, New York 20, New York.

The label instructions on Cyanamid products, and on products containing Cyanamid ingredients, are the result of years of research and have been accepted by Federal and/or State Governments. Always read the labels and carefully follow directions for use.

CYANAMID

MALATHION
INSECTICIDES

XUM

Infestation Report

Contains pertinent portions of the Department of Agriculture's Cooperative Economic Insect Report, material from university entomology departments and reports from readers. PCOs noticing infestations in their own areas are urged to communicate with *Pest Control* so their information may be added to this infestation report.

IMPORTED FIRE ANT
(*Solenopsis saevissima richteri*)

North Carolina: Surveys revealed 12 new properties infested in Craven County. Some with large mounds in field not cultivated for two years. Winged productive forms found in mounds in Craven and Carteret Counties. **Texas:** New infestation found in Montgomery County. Area of infestation believed to be at least one mile square just north of Conroe. A control program and eradication effort will be undertaken shortly.

THIEF ANT
(*Solenopsis molesta*)

Texas: Causing considerable nuisance in Bryan area of Brazos County by building nests in closets, laundry bins, clothes drawers, etc.

BATS

New York: City health officials in Utica are conducting tests to determine whether some strange acting bats may be rabid.

CARPET BEETLE
(*Anthrenus scrophulariae*)

Oklahoma: Heavy infestations damaging rugs in a home in the Stillwater area.

POWDER POST BEETLES

Oklahoma: Emerging from flooring in several newly built homes in Payne County. Approximately 7% of boards in floor show exit holes.

BOXELDER BUG
(*Leptocoris trivittatus*)

Utah: Annoying about some homes at Provo, Utah County. **New Mexico:** Nuisance because of large numbers entering homes in Rio Arriba County.

CUBAN COCKROACH
(*Panchlora nivea*)

Rhode Island: One individual found in Cranston home. Family in home recently received a fruit package from Texas.

ORIENTAL COCKROACH
(*Blatta orientalis*)

Oklahoma: Moderate to heavy infestations noted in 4 homes in Stillwater area.

EARWIGS

Arizona: An undetermined species a problem around homes in Phoenix area of Maricopa County. Species occurred throughout summer and fall, staying in grass near base of house during day and coming out at night or when disturbed. They also enter homes at night when an entrance place is available. Damage to plants not observed. **Oklahoma:** Ringlegged earwig (*Euborellia annulipes*) present in annoying numbers in two restaurants in Comanche County and a home in Johnston County. **Texas:** Probably *Labidura riparia* continue to draw complaints from residents in Bryan-College Station area who report earwigs in homes at night.

FACE FLY
(*Musca autumnalis*)

Virginia: Very common in association with *Pollenia rudis* and species of blow flies in and around a three-story home in Pulaski County.

CLOVER MITE
(*Bryobia praetiosa*)

Utah: Invading several homes in Salt Lake City.

MOSQUITOES

Texas: *Culex* spp., mostly *C. salinarius*, continued to occur in larger numbers in Jefferson County whenever temperatures permit migration. *Uranotaenia sapphirina* taken at Port Arthur; *Anopheles crucians* occurred throughout Jefferson County; *Anopheles quadrimaculatus* occurred in mid-Jefferson County and Beaumont area; and *Culiseta inornata* was generally distributed in Jefferson County.

INDIAN MEAL MOTH
(*Plodia interpunctella*)

North Carolina: Larvae abundant in old soybean bags at crop improvement warehouse in Wake County. **North Dakota:** Several light infestations found in grain and seed storage facilities at Fargo, Cass County. **Oklahoma:** Infestations in cereal products causing some concern in few homes in Stillwater area.

CASEMAKING CLOTHES MOTH
(*Tinea pellionella*)

North Dakota: A very severe larval infestation reported damaging wool carpeting at Dickinson. **Oklahoma:** Heavy infestation noted in rugs in two homes in Perry and Bartlesville, north central area. Heavy infestation causing severe damage to rugs in home in Stillwater.

SILVERFISH
(*Lepisma* sp.)

New Mexico: A problem in home in Las Cruces, Dona Ana County.

RABID SKUNKS

California: Four rabid skunks were caught, two in Northridge, one in Granada Hills, and one in Chatsworth, in a 10-day period. Steps being taken to curb danger of rabies from the animals.

BLACK WIDOW SPIDER
(*Latridectus mactans*)

New Mexico: Causing some concern among residents of communities throughout southern counties where adult females are being found in relatively large numbers.

BROWN DOG TICK
(*Rhipicephalus sanguineus*)

Arizona: Heavy populations a problem around some homes in Phoenix area of Maricopa County. **Texas:** Entering homes in Brazos County.

WINTER TICK
(*Dermacentor albipictus*)

Oklahoma: Common throughout eastern portion of state.

RICE WEEVIL
(*Sitophilus oryza*)

Oklahoma: Infestations in cereal products in few homes in Stillwater area causing some concern and annoyance.

Norda Gets a DDVP Patent

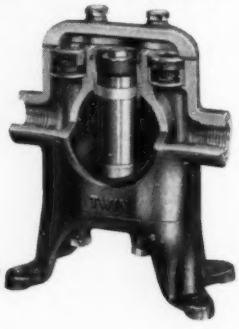
A patent relating to the control of cigarette beetles with vapors of DDVP has been assigned Norda Essential Oil and Chemical Co., New York City. Patent No. 2,968,591, dated Jan. 17, 1961 was originally filed May 8, 1957.

HIGH-PRESSURE — LOW HORSEPOWER
HYPRO PRESSURE-TREAT UNIT
FOR TERMITE CONTROL

WITH HYPRO SMALL-TWIN PISTON PUMPS
TWO SIZES: 2 GPM and 3 GPM (at 1800 RPM)

PRESSURES TO 400 LBS. WITH ONLY ½ HP MOTOR

Doesn't take much to power these pumps up to 400 psi . . . ½ HP for 2 GPM models, 1 HP for 3 GPM models (½ HP at 200 psi). AT LOW COST, here's plenty of pressure for deep penetration — for thorough termite treatment and other PC jobs. Features: ball bearing construction, stainless steel valves, Ni-Resist sleeves, choice of leather or specially compounded rubber cups.



WRITE FOR INFORMATION ON HYPRO PC PUMPS

Hypro Engineering, Inc.

Dept. D, 706 39th Avenue N.E., Minneapolis 21, Minn.

Your Best Buy for '61 is...

SN. 7 SWINGFOG with Magic Magneto Start

The Professional Fogger

The Best in

- √ Quality
- √ Performance
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- √ Portability
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When You Need the BEST FOGGER . . . BUY SWINGFOG

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SOUTHERN MILL CREEK PRODUCTS CO., INC.

P. O. Box 4297 NATIONAL DISTRIBUTORS **Tampa 7, Florida**

SILICA DUSTS ARE NOT ALL THE SAME!

Only Silikil...

- *IS EASY TO APPLY!*
- *HAS EXTREMELY FINE BUT HEAVY PARTICLES!*
- *ADHERES EVENLY TO ALL SURFACES!*
- *HAS APPROVAL OF LEADING PCOs!*
- *IS EFFECTIVE UNDER HUMID CONDITIONS!*
- *HAS WORLD-WIDE DISTRIBUTION!*

Silikil for positive control of **DRYWOOD TERMITES, ROACHES, FLEAS, SILVERFISH, ANTS, FLIES!**

Manufactured by

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DISTRIBUTORS: Artco Products, Wilmington, Calif. ● Black J Chemical Co., Los Angeles, San Mateo, Santa Monica (Calif.) ● L. H. Butcher Co., Seattle, Portland (Oregon), San Francisco, Los Angeles ● Calchem Distributing Corp., Los Angeles ● Florida Agricultural Supply Co., Jacksonville, Florida ● General Fertilizer & Supply Co., Chula Vista, Calif. ● Great Western Chemical Co., Seattle, Portland (Oregon), San Francisco, Los Angeles ● Los Angeles Chemical Co., Southgate (Calif.) ● Miller Products Co., Portland (Oregon) ● Prentiss Drug & Chemical Co., Inc., New York, Chicago ● Redwood Chemical Inc., Houston, Texas ● Remark Chemical Co., Miami, Florida ● Shaef Chemical & Supply Corp., Bradenton, Florida ● S. B. Penick & Co., New York, Chicago, St. Louis ● Southern Pest Control Co., Charlotte, N. C. ● F. M. Speekman, San Francisco, Fresno (Calif.) ● Stephenson Chemicals, College Park, Georgia ● Thompson-Hayward Chemical Co., Kansas City, Houston, Dallas, New Orleans, Memphis, Denver, Omaha, St. Louis ● York Chemical Co., Brooklyn

Hawaii: Pacific Chemical & Fertilizer Co., The Diversey Corp., Ltd., Hawaii Chemical Co., Ltd.

International Distributor: Velsicol International Corp., New York, Nassau, Bahamas

Book Reviews

The Beetles of the United States

by Dr. Ross H. Arnett, Jr. The Catholic University of America Press, 620 Michigan Ave., N.E., Washington 17, D.C., 1960, Sec. 1, 210 pp. $3.50.

The late L. L. Buchanan, former head of the Coleoptera section of the Division of Insect Identification, U. S. Department of Agriculture, is reported once to have said that the one thing he needed to help in his work with beetle identification is a simple tabulation of the morphological characters found in each of the beetle families. Dr. Arnett, now associate professor of Biology at The Catholic University of America in Washington, once worked at the U. S. National Museum and started work on this beetle identification manual Dr. Buchanan had wished for.

Section 1 is the first of about eight sections to be published over a two-year period. It covers Cupedidae, Rhysodidae, Cicindelidae, Carabidae, Amphizoidae, Haliplidae, Dytiscidae, Noteridae, and Gyrinidae. In all, 110 families will be covered by the entire work.

Divisions of this section and the book as a whole are made up in looseleaf form so they can each be arranged according to the needs of the user. Each division is restricted to a single family of beetles. Preceding the actual discussions of each family which include illustrations of pertinent body characters and keys to identification, there is an extensive introduction that covers the external anatomy of adult beetles, a key to the families of Coleoptera of the world, a bibliography, and an index to Section 1.

This is a deeply scholarly presentation of morphological information that will be primarily of interest to the serious student of beetles. It covers beetles found in the USA, exclusive of Alaska and Hawaii, and in parts of Canada and Mexico.

Price of the complete work is $25.00, plus $3.95 for a 3-post Buchram stiff cover binder which every purchaser of the book should have.

Laboratory Notebook for Introducing Entomology

by Elizabeth E. Haviland. Burgess Publishing Co., 426 South Sixth St., Minneapolis 15, Minn. 61 pp. $2.25.

Designed primarily for entomology students, this loose leaf type notebook is arranged for laboratory use throughout the semester of a course.

Topics contained in the text include head and mouth parts of insects; thorax and abdomen of a grasshopper; wing venation studies and other Diptera; and principles in chemical control, insect classification, and instructions for making an insect collection.

Material is offset in typewriter type on perforated paper so students can remove pages to insert them into a three-ring binder. Blank paper is provided for laboratory notes. Drawings of insect parts and a listing of insect names are printed in duplicate so students can have a copy in the laboratory and one in a loose leaf binder for study outside the lab.

The author is assistant professor of entomology at the University of Maryland.

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Notebook

TIPS AND IDEAS FROM THE FIELD

What Degree Stability?

by

WILLIAM HAZELTINE

Extension Entomologist,
Purdue University, Lafayette, Indiana

What stability of insecticidal emulsion is the best? This question has been asked many times by industry members. Some experts claim that for pest control, an extremely stable emulsion is better, while others prefer a quick-breaking one. Most of these statements are based on theoretical consideration and not on laboratory evidence of the relationship of stability to residual effectiveness. As reported by Howard Rosenbaum (*Pest Control*, Oct. '59, p. 66) formulators are prepared to furnish any degree of emulsion stability that the industry desires, but how do we know which is the best?

Stability or speed of emulsion "breaking" for crop uses has been investigated and reported in the literature many times, but we are not primarily interested in crop spraying. We need to know what emulsion character is best for inside spraying and soil treatment. We have seen demonstrations of emulsion "performance," but is it really performance that we have seen? A realistic evaluation would be that we have seen part of the performance, but what happens on surfaces or in the soil? A certain amount of stability is necessary to get uniform applications, but even this can be compensated for by continuous agitation.

At present, the pest control industry is still guessing at the answers, but guessing can be costly in this business. Answers can be obtained only through research and testing under laboratory and field conditions.

The pest control industry will have to finance this research, either directly as an industry-sponsored program or indirectly through higher costs for emulsifiable concentrates. In the latter case, formulators could justify the expense of such a program. Cheap formulations usually sell on the merit of price; a quality product on its superior performance. The PCO can get the ball rolling when he starts asking for insecticidal test data when he buys emulsion concentrates.

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Gross sales for Orkin Exterminating Co. were said to have increased $3,593,894 during the fiscal year ending in October, 1960. Total sales for the year were $30,253,868.

A company statement indicated that since 1952 the Atlanta-based firm has boosted its sales 322%.

In addition to its sales growth, the firm established 82 new offices in its 28-state territory during the fiscal year, bringing the total to 525 branches. Plans are also being made for 1961 expansions in Ohio, Illinois, California, and Indiana.

New Milwaukee Catalog Ready

A new 12-page catalog describing the full line of its 1961 portable electric tools and accessories can be obtained from the Milwaukee Electric Tool Corp., 5300 W. State St., Milwaukee, Wis. Ask for catalog No. G20.

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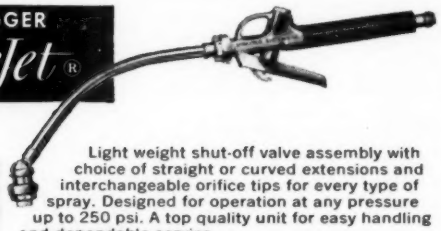

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Calendar

Central Midwest PCO Conference, Town House Hotel, Kansas City, Kans., March 9, 10.

New Jersey Pest Control Assn., Monthly Meeting. Rutgers University, Department of Entomology, New Brunswick. March 15, 8 p.m.

Michigan State University PCO Conference, East Lansing, Kellogg Center, March 16, 17.

Texas Pest Control Assn. Monthly Meeting. Town House, San Angelo, March 18, 10 a.m.

Washington Pest Control Assn., Monthly Meeting. 4904 Wisconsin Ave., N. W., Washington D. C., March 20, 8 p.m.

Alabama PCO Licensing Exam., Agricultural Bldg., State Fair Grounds, Birmingham; Courthouse, Decatur; Courthouse, Gadsden; State Vocational School, 925 Fulton Rd., Mobile; 822 State Office Bldg., Montgomery. March 21.

Pest Control Assn. of South Florida, Monthly Meeting. Lindsey Hopkins Vocational School, 1410 N.E., 2nd Ave., Miami, March 27, 6:45 p.m.

Hawaiian Pest Control Assn., Monthly Meeting. Evergreen Restaurant, Honolulu, March 28, 7 p.m.

New Jersey Mosquito Extermination Assn. Annual Meeting. Hotel Chalfonte-Haddon Hall. March 29-31.

Canadian Pest Control Operators Assn. Annual Conference. K.C. Neatby Building, Experimental Farm, Ottawa, Ontario. April 24, 25.

Chemical Specialties Manufacturers Assn. 47th Mid-year Meeting. Drake Hotel, Chicago, Ill., May 15-17.

Florida Pest Control Assn. Annual Convention. Holiday Inn, Palm Beach. June 23, 24.

Ohio Pest Control Assn., Mid-summer Meeting. Midway Motel, Pearl Rd., Cleveland, Aug. 3-5.

Pennsalt Has Animal Repellent

An animal repellent to protect trees and ornamentals from rabbits, field rodents and other bark-chewing invaders, has been developed by Pennsalt Chem. Corp.

Containing thiram as its principal ingredient, Penco Thiram Animal Repellent can be applied either during the dormant or growing seasons and is formulated for further dilution with water for sprays, dips, or brush application.

According to its manufacturers, the repellent, when properly applied, protects plant life from gnawing animals for a period of six months and longer, depending on weather conditions.

To obtain more details about this product write to Agricultural Chemicals Divison, Pennsalt Chemical Corporation, 2901 Taylor Way, Tacoma, Wash.

Davis' PC History Ready

"A Contribution to the History of Pest Control," a 108 page, illustrated recollection of the historical events, past and present, that have brought the best control industry to where it is today, is now available.

Written by J.J. Davis, retired chief of Purdue University's entomology department, copies of the book can be obtained by sending $3.00 to Professor Davis, Department of Entomology, Purdue University, Lafayette, Ind. Only 300 copies have been printed.

Ind. PCOs Re-elect Cochnower

Harry J. Cochnower, Cochnower Pest Control Service, Lafayette, Ind. was re-elected president of the Indiana Pest Control Association at its meeting during the Purdue PCO Conference in Lafayette.

Other officers chosen for 1961 are Louis B. Lacy, Arab Pest Control, Bloomington, vice-president; Louis Berzai, South Bend Exterminating Co., director; and Purdue professor emeritus, J.J. Davis, secretary-treasurer.

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Publications *to write for...*

Here are the latest government, university and association publications of interest to pest control operators. Some can be obtained free of charge, while others are nominally priced. When ordering, include title and catalog number, if any. Sources follow booklet titles.

Recent Developments in Pesticides. Reprint No. 307. 5p. May 1960. Communicable Disease Center, Technical Development Laboratories, P.O. Box 769, Savannah, Ga.

Metabolism of Insecticides by Various Insect Species. Reprint No. 311. 6 p. July, August 1960. Communicable Disease Center, Technical Development Laboratories, P.O. Box 769, Savannah, Ga.

Evaluation of Synergists for Pyrethrum and Allethrin Against the Body Louse. Booklet No. ARS-33-62. 64 p. October 1960. Agricultural Research Service, U.S. Department of Agriculture, Washington 25, D.C.

Effects of DDVP Aerosols on Blood Cholinestrase of Fogging Machine Operators. Reprint No. 298. 2½ p. January, 1960. Communicable Disease Center, P.O. Box 769, Savannah, Ga.

Investigations on the Mechanism of DDT Resistance in Certain Anopheline Mosquitoes. Reprint No. 310. 14 p. 1960. Communicable Disease Center, Technical Development Laboratories, P.O. Box 769, Savannah, Ga.

DDT Resistance in *A. Quadrimaculatus*. Reprint No. 309. 4 p. May 1960. Communicable Disease Center, Technical Development Laboratories, P.O. Box 769, Savannah, Ga.

Insecticide Resistance in *Aedes Aegypti*. Reprint No. 301. 6 p. 1960. Communicable Disease Center, Technical Development Laboratories, P.O. Box 769, Savannah, Ga.

Colonization and Production of a Dieldrin-Resistant Strain of *Anopheles quadrimaculatus* Say. Reprint No. 299.2 p. February, 1960. Communicable Disease Center, Technical Development Laboratories, P.O. Box 769, Savannah, Ga.

How to Control Rats and Mice. Leaflet No. 127. University of California, College of Agriculture, Agricultural Experiment Station, Berkeley 4, Calif.

Rat and Mouse Control. Publication No. F183. Michigan State University, Dept. of Information Services, Bulletin Office, 10 Ag Hall, P.O. Box 231, East Lansing, Mich.

Field Rodents, Public Health Importance and Control. Catalog No. FS 2.60/2: R 61/2. 4 p. il. 1960. Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C. 5c.

Controlling Insects and Diseases on Ornamental Trees. Bulletin No. E269. Michigan State University, Dept. of Information Services, Bulletin Office, 10 Ag Hall, P.O. Box 231, East Lansing, Mich.

Pest Control Program for Home Orchards and Small Fruits. Publication No. F17. Michigan State University, Dept. of Information Services, Bulletin Office, 10 Ag Hall, P.O. Box 231, East Lansing, Mich.

The Zimmerman Pine Moth. Research Bulletin No. 698. August 1960. 7p. il. Purdue University, Agricultural Experiment Station, Lafayette, Ind.

Elm Bark Beetles. Catalog No. A1.35:-185/3. Rev. 1960. 8p. il. Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C. 5c.

How to Take Accurate Soil Samples. Publication No. F278. Michigan State University, Dept. of Information Services, Bulletin Office, 10 Ag Hall, P.O. Box 231, East Lansing, Mich.

The House Fly, How to Control It. Catalog No. A 1.35:457/2. 1960. 6p. il. Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C. 10c.

The European Earwig, How to Control It Around the House. Catalog No. A 1.77/ a:1/3. Rev. 1960. 28 p. il. Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C. 5c.

Causes of Outbreaks of Stored Grain Insects. Bulletin 416, 34 p. il. February, 1960. Agricultural Experiment Station, Kansas State University, Manhattan, Kansas.

Insect Control for Motels, Resorts, Cottages. Catalog No. R203. Michigan State University, Dept. of Information Services, Bulletin Office, 10 Ag Hall, P.O. Box 231, East Lansing, Mich.

Public Health Service Film Catalog. Catalog No. FS 2.2: F 48/2. June 1960. 66p. Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C. 50c.

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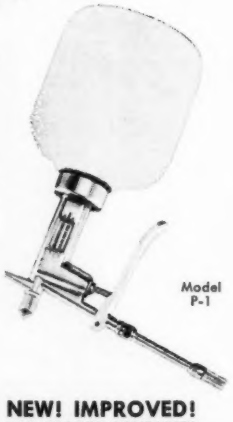

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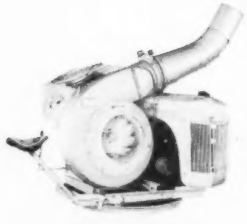

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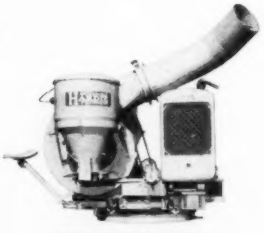

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School to Train Servicemen

On the job training for pest control servicemen and sanitarians is being offered by the Elston School of Pest Control, recently formed in Chicago.

The school's founder, PCO Robert E. Berns, said two-week courses, consisting of 12 daily lessons, will stress practical training designed to assist pest control firms indoctrinate service employees. He said lessons on equipment, pesticides, rodents, roaches, and safety will be included in the course.

Elston School is said to be licensed by the Department of Registration and Education of Illinois. For more details on enrollment and fees write at Elston School of Pest Control, 4674 Elston Ave., Chicago, Ill.

Aerosol Sales Continue Climb

Push-button aerosol production in the U.S. and Canada is expected to near 700 million units in 1961, according to the Aerosol Division of the Chemical Specialties Manufacturers Association. In market value, this represents more than $750 million, approximately 97% accounted for by this country.

Production of non-food aerosol products, which has increased by more than 20% annually over the past five years, stood near the 575 million mark in 1959.

Aerosol insecticides are among the leading push-button products showing this healthy increase.

A Sure Shot pressure sprayer charged by a carbon dioxide cartridge is now being marketed by Milwaukee Sprayer Manufacturing Co. It is designed to apply a steady stream of insecticide or disinfectant through a 12-inch flexible extension or a 6-inch rigid nozzle. The unit is a chrome plated brass or enameled steel shell tank which holds one quart of liquid and 100 pounds of pressurized air. Further data can be obtained from the company at 2437 W. Fond du Lac Ave., Milaukee 6, Wisconsin.

Suppliers Staff Changes

Morton Chemical Company has appointed **Larry Gallagher** sales representative in the company's North Central region. Among the products he is selling are larvacide grain fumigants. **Charles M. Gates** has been made technical sales representative for soil pesticides and will cover six midwest states and Canada.

Geigy Agricultural Chemicals announced the appointment of **Leo K. Calhoun** and **Douglas Knapp** as sales representatives in the South. Calhoun, formerly with California Spray Chemical Corp., will cover Alabama; Douglas, a former assistant county agent with the Florida Agriculture Department, will canvass southern Florida.

Michigan Chemical Corp. has promoted **Thomas B. Sparks** to manager of market research and development of its Chemical Division. He was formerly the Chemical Division product manager. **George J. Coleman** has joined the company as technical sales representative in the eastern sales territory.

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See the CDC Report in this issue on vermiculite granules for mosquito control.

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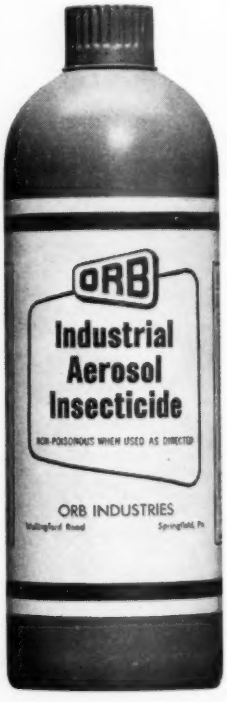

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The Best High Potency Formula to Flush Out and Control Roaches.

"Roach Router" Extension Nozzle 12 Inches Long With ORB Bomb Reaches Into the Inaccessible Spots.

2½ # lightweight disposable container. Write for details.

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RAT CAFETERIA KILLS RATS!

Feeds 1 Full Quart Of Liquid Bait And More Than 6 Pounds Of Dry Bait

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• CERTAIN
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SIZE 7 3/4 x 13 x 13

NESTED DESIGN SAVES YOU MONEY
New, slanted-side design nests 6 units to a carton. Saves 50% on freight, 50% on storage!
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Today's largest-selling bait station. Approved by health authorities everywhere. Fabricated of heavy galvanized steel. Many report over 5 years of continuous use. No identification. Imprint your name.

Sample Cafeteria $3.00; Lots of 12, $2.25 ea. Lots of 48, $2.10 ea. Lots of 102, $1.95 ea. All prices F.O.B. Madison, Wis.

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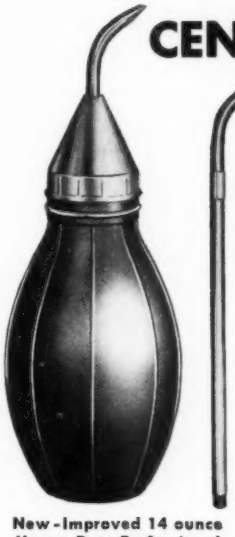
Servicemen Prefer the CENTROBULB "B"



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CENTROBULBS have largest openings for instant filling — are equipped with screens to keep particles from nozzle tips — made for heavy-duty professional work — made of best grade seamless rubber with tops made of machined die-cast zinc with removable brass tip — air-tight, with leak-proof gaskets.

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KILLS ALL KINDS OF INSECTS
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Easy to Install RID-A-BIRD PERCH ELIMINATES BIRD PROBLEMS

Unsightly, unsanitary and costly conditions caused by pest birds can now be safely solved by the unique Rid-A-Bird perch. Easily installed (see photo) and refilled only twice a year, the perch insures permanent removal of sparrows, starlings and pigeons. Successful installations include factories, aircraft hangars, grain elevators, loading docks, warehouses, farm buildings, garages, stores and buildings.

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When answering ads where box number only is given, please address as follows: Box number, c/o Pest Control, 1900 Euclid Avenue, Cleveland 15, Ohio.

Rates: "Position Wanted" 5c per word, minimum $2.00. All other classifications, 10c per word, minimum $2.00. All classified ads must be received by Publisher the 10th of the month preceding publication date and be accompanied by cash or money order covering full payment.

POSITION WANTED

GRADUATE ENTOMOLOGIST. Thirteen years experience in general pest control and termite control. Management and sales experience. Seeks opportunity with progressive firm. Prefer northeastern U.S. but will consider other areas. Write Box 575, Pest Control magazine.

POSITION WANTED. Thirteen years experience office management, sales, pest and termite control. Age 40, excellent health. Now in Central Illinois willing to relocate in Midwest for permanent position of responsibility and advancement. Write Box 579. Pest Control magazine.

HELP WANTED

MANAGER WANTED in Central Illinois. Are you married, neat, and experienced in the termite control field? Due to ill health I need a man to completely manage my business. Send qualifications to Box 576, Pest Control magazine.

WANTED TO BUY

ESTABLISHED CHICAGO PEST Control Company seeking to purchase one or more Chicago exterminating companies. Any size. Give details and phone No. Box 583, Pest Control Magazine.

PEST CONTROL BUSINESS in New York State. Give Details and Price. Replies Confidential. Box 582, Pest Control magazine.

WANTED TO BUY pest control firm or interest in firm in the South or preferably in the Southwest. Have college training and 15 years experience. Box 578, Pest Control magazine.

PEST CONTROL BUSINESS anywhere in South. Replies confidential. Atlas Exterminators, Inc., 512 Houston St., Mobile, Alabama.

FOR SALE

2-USED DYNAFOGGER Jrs. $100 each. Truley Nolen, 3575 E. Speedway, Tucson, Arizona.

PEST CONTROL BUSINESS established in New Jersey 30 years, near N.Y.C. Grossing over $20,000 annually. Wonderful opportunity for aggressive young PCO. You can operate under corporation name. Asking price, $19,000. Reason for selling, retiring. Box 580, Pest Control magazine.

CALIFORNIA PEST Control business (eight various divisions). Originally established in 1934. Five trained employees, two state licensed, three over 15 years experience. Located center growing city near Los Angeles, over one million people, radius less than 10 miles. Five year lease with renewal present main street location. $10,000 will handle with good credit-terms. Retirement reason for selling. Write Box 581, Pest Control magazine.

DYNA-FOG, SR. 2 years old, excellent condition. Reply to Box 567, Pest Control magazine.

WILL TRADE Curtis Dynafog Jr., '58 model for comparable power duster usable for oil misting, or will sell fogger best offer, or will buy good duster. P.O. Box 426, Menlo Park, Calif.

Legislation Affecting PCOs

Tennessee has *passed into law* House Bill No. 50, effective July 1, 1961, which amends sections of the Tennessee Code pertaining to insecticides, fungicides, and rodenticides.

Under the amended sections are new definitions for economic poisons, devices, insecticides, fungicides, herbicides, nematocides, plant regulators, defoliants, desiccants, nematodes, weeds, insects, fungis, ingredient statements, labels, adulterated, and misbranded products.

New fees are set for selling or offering for sale any economic poison in Tennessee.

Colorado has *pending* legislation, House Bill No. 160, concerning regulated use of insecticides, fungicides, rodenticides, and other economic poisons and devices for agricultural purposes.

The intent of this bill is to amend the Colorado Insecticide, Fungicide and Rodenticide Act by adding plant regulators, defoliants, desiccants, and nematocides to conform with the amendment to the Federal Act.

New Mexico has *pending* legislation, House Bill No. 89, intended to ammend the New Mexico Economic Poisons Act by adding defoliants, plant regulators, desiccants, and nematocides. It is similar to the amendment to the Federal Insecticide, Fungicide, and Rodenticide Act.

Texas has *pending* legislation, Senate Bill No. 76, intended to establish a Texas Applicators Pest Control Council and regulate the activities of aerial applicators of pest control chemicals.

Under the proposal, a "custom applicator" is defined as "any person who owns, leases, rents or otherwise secures one or more apparatus in order to make applications of pesticides or other custom application of seed or farm chemicals."

For more details on these pieces of legislation, contact the legislatures of the states involved.

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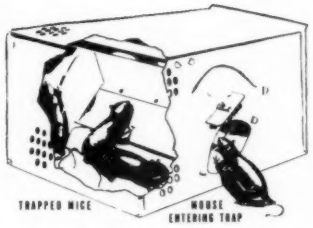

Completely Automatic

Safe, No Bait Necessary
Catches Up to 15 Mice at a Setting. *Guaranteed*

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The World's FINEST TRAP For Farm, Home and Industry

Used Successfully BY EXTERMINATORS
Catches mice when other traps and poison fail

For Further Information and price, write

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The Original . . .
And Still The Best!

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$1.50 EACH F.O.B. St. Louis, Mo.

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SMITH SPRAYERS

"For 73 Years Choice For Quality The World Over"

Complete line of hand, continuous, compressed air, knapsack, bucket, wheelbarrow and barrel sprayers and insecticide dusters. Many styles of spray nozzles. Quality design and performance.

Streamlined BLIZZARD
Copper Continuous Sprayer

World's Finest
Two Sizes: Pint, Quart (39 ounces)

Solid copper tank. Seamless, highly polished brass pump barrel. Beautiful design. Sturdy construction. Lasts for years. Double nozzle sprays fine, powerful mist straight ahead or at any ang...

E-Z 5 GAL. KNAPSACK SPRAYER

Best knapsack sprayer made. Pump lever quickly develops high pressure. 5 gal. zinc grip steel or copper tank. Adjustable nozzle for 20-30 ft. or short, fine, powerful mist spray. Unexcelled for every spraying need.

RITE SIZE SPRAYER

2 Gal., compact compressed air sprayer. Dome top welded tank 5 ft. hose. 16" curved brass extension. Brass adjustable nozzle. Very popular. Light and easy to use.

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D. B. SMITH & CO., 440 Main St., Utica 2, N. Y.

FUMO-KILL *Two Way* MONEY MAKER !

The New Effective Fumigant That Will Kill

Mosquitoes, Flying Moths, Spiders, Silverfish, Flies, Wasps, and Exposed Waterbugs, Roaches, Bedbugs, and Ants

Follow instructions on can for best results

USE IT! SELL IT!
FUMO-KILL has the following advantages:

EASY TO USE: Requires no Special Equipment.

ECONOMICAL TO USE: Two ounces fumigates up to 6,000 cubic feet.

FUMO-KILL is truly the modern method of insect extermination. Light match to contents of can, will produce fumes — NO FLAME. Non-hazardous. This amazing FUMO-KILL insecticide has been tested, and found effective against most types of household pests.

This amazing FUMO-KILL insecticide is by all qualifications a leader in its field.

For complete information write or phone today

Available Only From **MAR-MEL *Products, Inc.***

Phone Van Buren 6-2060—61

753 South Kedzie Ave. Chicago 12, Illinois

FUMO-KILL can be obtained in 2 oz. (enough for up to 6,000 cubic feet)—4 oz. and 1-lb. cans.

Cost of 12—2-oz. Cans . . . . $ 7.50 per doz.
Cost of 12—4-oz. Cans . . . . 13.50 per doz.
Bulk . . . . . 4.50 per lb.

Delivery Charges Prepaid

Calendar

New man. **Edgar J. Poh, the front office man PCOs talk to at Chapman Chemical Co. in Memphis, has been made manager of the firm's Pest Control Chemical Products Division. But Ed's a new man in more ways than one. When last we encountered him we almost passed him by unnoticed because this svelte gentleman from the South has dieted off 70 lbs. This is a case where Chapman picked a smaller man for a bigger job!**

* * *

Capitol punishment. Starlings, lined up atop the U.S. Capitol waiting for the Inaugural Parade to begin, were ousted from their grandstand seats by rifle shots from inconsiderate capitol guards who wanted to welcome only one new bird into the presidential territory. Besides, the top hats might have been too attractive a target.

* * *

Quite a speaker. **Those of you who remember Bill Buettner's younger son, Teddy, to be a vivacious, energetic and agile youngster will not be surprised to learn he is developing into a talented young man. At the banquet during the Purdue PCO conference where William O. Buettner was honored during silver anniversary ceremonies, Teddy Buettner gave an eloquent speech paying tribute to his father. His respectful presentation left no doubt that here was truly Bill's scion. Ted tells us he plans to study entomology and perhaps one day enter the pest control business.**

* * *

Brussells bustles hustle. Lady shoppers in two department stores in Brussells, Belgium left in a big hurry when a man let loose a flock of white mice in the stores during the recent political demonstrations in that country. Bet the little cheese eaters didn't phase women customers crowded around the bargain counters.

* * *

Last supper. **Sid Steenburgh, who runs A-1 Exterminators in Davenport, Ia., told us recently of discovering a termite infestation because the timber munchers had greedily gnawed their way through a wall and then continued to digest the backing of a picture that hung on it. The work would have gone unnoticed except for the fact that the piece of art was a reproduction of The Last Supper and folks began to get curious when one by one the disciples began to disappear. Sid was called and the termites were eliminated.**

* * *

Southern who's who? Operators attending the Southern PCO conference had a little trouble recognizing their Dixie colleagues from Montgomery, Ala. who wore beards commemorating the Civil War Centennial.

* * *

Never too old. **Virgil Smith, veteran Forest Service researcher who's been working at the Gulfport, Miss. wood destroying organisms research laboratory, has gone back to school. Virgil, who has a 19-year old boy in college and a girl in high school, has entered Purdue to work on his doctorate degree. His study into the life and habits of termites is being jointly financed by a grant from the U.S. Forest Service and Bird & Son, vapor barrier manufacturers.**

* * *

Drawkcab gag. Floridian Pest Control Co., Miami, which has its name printed backwards on its truck as an attention-getting gag, was a little surprised to receive a check with the name printed exactly as on the truck. It cleared the banks without a hitch, reflecting that bank managers also have recognized the mirrored name.

* * *

50th year. **To mark its 50th anniversary, Ratner Pest Control, Atlantic City, N.J., is distributing gold-colored calling cards which have drawn appropriate complimentary comments from its customers. Congratulations, Simon and Herman; may the next 50 years see you make an even better killing than you have in the first half century.**

* * *

Passes on. **Veteran PCO, Max J. Levy, 76, of Twin City Exterminating Co., St. Paul, Minn., passed away February 1 after a long illness.**

* * *

Bum wrap. **Harold L. Coleman, Faultless Exterminating Co., Kansas City, Kans., had a very hectic after-dinner hour while at the Purdue Conference. He had to race back in a taxi to a restaurant five miles away where he picked up the wrong coat from the rack. He arrived just as the coat's owner was complaining to the manager. Hal apologetically exchanged coats and whisked back to the Union Club $4 in taxi fares poorer for the mistake.**

KILL the odor

in insecticides and other strong smelling chemical specialities with

MALASCENT

Here is a new and amazingly effective reodorant for insecticide formulas. It quickly, efficiently and economically covers and neutralizes the unpleasant odors so often present in products used for pest control. Only ¼ ounce is necessary to reodorize a full gallon of insecticide formula—either oil or water based. Why not order a trial pound for your own tests. The low, low price is only $3.00 per pound.

Reodorize 1 gallon of insecticide for only 4½ cents.

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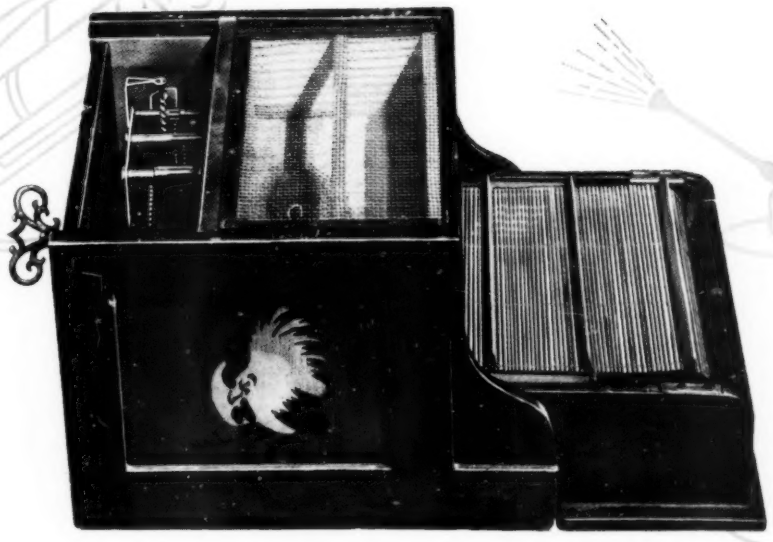
No sense trying to build a better fly trap...



when Fairfield's

PYRENONE*

puts fly control at your fingertips!

Considered the last word in fly control in 1900, this handmade, spring-powered fly catcher is a prized antique today. Yet, in grandfather's time when baited with sugar syrup, it slowly carried feasting flies into captivity... trapped them inside a wire cage! With the motor fully wound, the fly catcher operated for more than an hour.

What makes fly control so effective and so modern today is the speed with which modern insecticides go to work. Unlike the mechanical fly trap, a Pyrenone base insecticide plays no favorites. It quickly knocks down and kills flies throughout the spray area... resistant or otherwise. Pyrenone, the fast acting, remarkably safe combination of piperonyl butoxide and pyrethrins, is the active ingredient in the most effective fly sprays made. Whether used for farm, for home or industry, Pyrenone base insecticides pack the punch that customers everywhere require.

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CONTROL ALMOST EVERY PUBLIC HEALTH PEST THAT CRAWLS OR FLIES...

even resistant species!

with NEW

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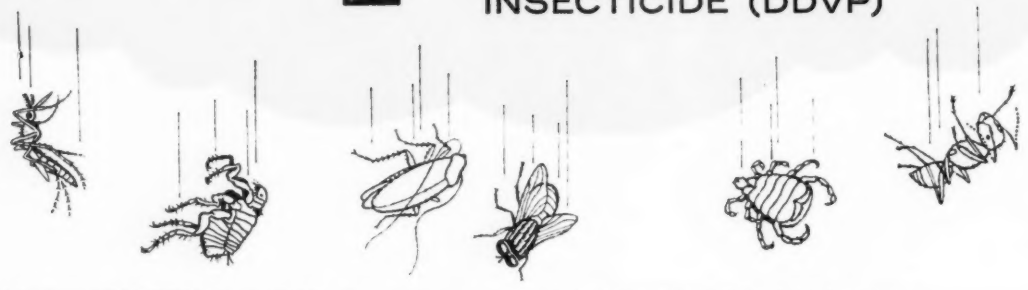
INSECTICIDE (DDVP)



Now with new VAPONA insecticide you can put more power and more profit into your pest control operations. This revolutionary insecticide promises to be the hottest public health pesticide to come along in many years . . . even for resistant insects.

Vapona insecticide performs differently than conventional insecticides. Its lethal power is carried in vapor form. No longer can insects avoid insecticide contact in cracks, crevices and other hiding places. It gets the job done quickly, then disappears with ordinary ventilation.

Vapona insecticide's extremely low dosage means low cost. And it can be applied using ordinary pest control equipment and techniques.

Vapona insecticide controls houseflies, cockroaches, mosquitoes, fleas, brown dog ticks, cigarette beetles, tobacco moths, Phorid flies, face flies, spiders, ants and a host of other pests. It can be used in: horse stables, animal buildings, milk sheds, outdoor areas, tobacco warehouses, food processing plants, households, restaurants, theaters, and many other areas.

Put new insecticide power to work in your pest control operation with powerful, dependable Vapona insecticide. To get the full story on Vapona insecticide and its many applications, contact the district office nearest you.

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